THE IRON TRADE REVIEW

Volume LVII Cleveland, August 26, 1915 *No. 9*

Iron and Steel Production Grows

Plant Activities Expand—Shrapnel Bars Are in Demand —Finished Lines Advanced

Increased works activities reflect the feverish demand for early shipments of war material and the blowing-in of idle furnaces and the resumption of many mills only in part measure the tremendous tonnage of iron and steel on mill order books. The Illinois Steel Co. now is operating 24 of its 25 blast furnaces, the Bethlehem Steel Co. is blowing five out of six, and the Lackawanna Steel Co. is driving all of its seven stacks. A new 22-inch mill has begun rolling at Bethlehem, and work is being pushed on another battery of open-hearth furnaces. Lackawanna expects to light four additional steel-making furnaces next week, when it will have a total of 18 open-hearth and two Talbot furnaces in operation. Obsolete mills that have been out of the running for many years are being prepared for operation, and thus the iron and steel output grows apace. Shrapnel stock of large diameter is being diverted to rail mills for rolling and the absence of domestic rail tonnage is not being felt, for the present at least.

Pig Iron

Further advances in pig iron prices have been recorded in nearly all centers and while buying is not of such volume as marked recent activities, nevertheless, sales in the east for the week, largely Buffalo iron, aggregate nearly 50,000 tons. All producers are slow to quote for next year's delivery, although numerous inquiries for 1916 shipment are pending. The Westinghouse Electric & Mfg. Co. is in the market for 9,000 tons for second and third quarter for its Cleveland plant, and a quotation on 5,000 tons of southern iron through the first half was refused. In the east, $16 was quoted on 10,000 tons of basic and one lot of several thousand tons was placed at $15.50, delivered. A valley furnace sold 10,000 tons of basic at $14.25 and some producers in this district are now asking $14.50. Bessemer iron is firmly established at $15.50, valley, representing an advance of $1.50 in 30 days. A spectacular feature of this unusual market was the shipment this week of 2,500 tons of bessemer iron by special train to catch a ship sailing Thursday for Italy.

War Orders

Large orders for shrapnel rounds are going begging, owing to the inability of mills to meet specified deliveries. France wants 50,000 tons monthly for the next six months, or a total of 300,000 tons, and another lot of 150,000 tons inquired for in the east remains unplaced. An English buyer in Pittsburgh is trying to obtain 25,000 tons of finished and semi-finished material, but none of the mills can make the required shipments. The Baldwin Locomotive Works again is in the market for 17,000 to 18,000 tons of shell bars, another eastern buyer wants 1,350 tons, and a Wisconsin woodworking machinery builder has made inquiry for 7,500 tons. Both Russia and France have just closed for 30,000 tons of shell bars, 15,000 tons each, with an eastern mill, and a 24,000-ton lot for Chester, Pa., will be closed soon. In the east, shell bars are quoted at 2.50 to 3 cents, mill, although in the south such business can be placed at 2.25c. Iron and steel bar specifications from implement makers and railroads are increasing and deliveries on merchant bars are being deferred.

Finished Lines

Plain wire has been advanced $2 and nails $1, while the lowered spelter price has resulted in a decline of $2 on galvanized wire products and $5 on galvanized nails. The disproportionate advances on plain wire and nails reduces the spread from $4, which remained unchanged for six years, to $3 a ton. Shafting has been marked up $1, spikes $2, blue-annealed sheets $1 and tool steel is commanding higher prices.

Two additional boats have been placed with an eastern yard, involving 8,000 tons of steel. Boats on seaboard berths now total 56. A large steel interest is inquiring for 10,000 tons of spiegeleisen.

Steel Corporation lake ore shipments will exceed 20,000,000 tons, indicating a total movement of 42,000,000 tons for the season.

Corporation rail contracts total 30,000 tons, of which 15,000 will be rolled by Tennessee.

THE OPEN HEARTH

Extending Foreign Trade

IN past years, business men have been rather slow in co-operating with the consular service and with other branches of the government connected with business affairs, for the reason that appointments were made largely for political reasons, and as long as the bureaus were nests of politicians, who had little or no ability to discharge their duties, practical men had excellent reason for mistrusting them. Gradually, however, the appointment of consuls and other officials connected with foreign and domestic commerce has been divorced from politics and put squarely on a merit basis. The result is that the bureau of foreign and domestic commerce of the department of commerce has reached a higher grade of efficiency than ever before, and now has in its service a number of men who are thoroughly trained for their important work.

In another part of this issue, an account is given of the work which is being done by the bureau's branch at Chicago, which has under its jurisdiction the territory including Minnesota, Wisconsin, Michigan, Ohio, the Pittsburgh district, northern Illinois and northern Indiana and is in charge of Dr. W. C. Hunnington, who is thoroughly equipped to render efficient service. Dr. Hunnington knows the steel business and his practical experience with the National Tube Co. which followed his graduation from Columbia University, was supplemented by a thorough post-graduate course in Germany. He is enthusiastic in regard to the prospects of helping iron and steel manufacturers to extend their foreign trade, and fortunately, the chief of the bureau at Washington, E. E. Pratt, is a man of great ability and under his direction, branch offices will be conducted on a thoroughly non-partisan basis, with the single purpose of promoting, in the most practical way, the development of American commerce.

Even while the great European war is at its height, foreign letters state that the modification of a proposal to form an ingot steel syndicate in Germany has been engaging the attention of the German steel trade. It is now proposed to call the new organization the German Steel League. One purpose is to limit the outputs of various kinds of products so that they will not exceed the demand, and an even more important plan is to render assistance to the export trade by working hand-in-hand with the German economic organizations. It is intended to form three sections, representing various kinds of products, and interesting details are being worked out. This movement is only one of those which show that when the war ends, Germany will be ready to resume the struggle for a large part of the world's commerce, and it behooves the United States, by using government agencies and in other business ways, to extend its foreign commerce and be prepared to prevent a serious invasion of the home trade by foreign countries.

A War Market in Steel

IT NEEDS only a casual observation and knowledge of the facts to reach the conclusion that the steel trade of the country, at the present time, is abnormal. With works operations at the highest point in history, or at the rate of 35,000,000 to 36,000,000 tons of ingots annually, it follows that there must be an extraordinary demand for finished product. Yet a survey of the domestic trade warrants no such conclusions. Railroad buying, the main prop of the industry in times past, is much below the average. Total car orders during 1915 to date have reached less than 60,000, of which only about 45,000 were for domestic lines. Rail orders have been larger this year than last, but the total has been swollen by a much increased tonnage for export, notable among which has been the 250,000 to 300,000 tons for Russia. General building activity in the country, despite some stimulus in the extension of plants making munitions of war, is considerably below normal. Agricultural buying of steel products and manufactures is said to leave much to be desired. Similar reports come from other branches of trade, though generally a gradual improvement is to be noted.

Broadly speaking, therefore, what the steel industry now possesses is a war market. The present rate of enormous production contrasted to the moderate domestic demand, demonstrates the gigantic proportions of the tonnage of steel that is moving directly or ultimately to the battle zone of Europe, or to countries which have had to find a new or greater source of supply here because their accustomed bases abroad have been denied to them, through various causes attendant upon the war.

The situation presents some curious anomalies. One of these is in structural steel. Although the volume of general building is below normal, various mills rolling this product are congested and buyers are being obliged to await an increasing time for deliveries. This is notably true of eastern mills. Some railmakers are unable or unwilling to handle any considerable new tonnage for this year. The explanation hinges on the limitation of crude steel supply which now is being reached. Extremely lucrative prices for steel rounds for shells, rifles, etc., is diverting a much heavier tonnage of raw steel into bar lines than ordinarily, despite any falling off in the domestic merchant bar demand. The dimensions of this realignment are difficult to estimate, but they chal-

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lenge the imagination when it is realized that the already large mill capacity in this product has been greatly extended through the conversion at the present time of no less than four rail mills to the rolling of large rounds.

The abnormal character of the present market has raised many doubts as to its permanency. That it will continue unabated as long as Europe remains at the deadly task of shooting away countless tons of steel, or Germany's grip on the bulk of the French and Belgian iron and steel industry deprives the allies of these resources, seems highly probable. What will happen when peace is declared, the mind of no man now is able to satisfactorily determine because of the sweeping character of the readjustment in the world's trade that unquestionably is growing out of the great conflict.

The part of wisdom, nevertheless, all things considered, for iron and steel workers of this country, seemingly lies in taking full account of the temporary character of their present business. The problem now and for the coming months will be to build up the purely domestic trade so that whatever future reaction may come, it will be minimized. It probably is a realization of this necessity that is causing conservative counsel to be raised against a more rapid advance of prices for steel products which the proportions of the current demand would seem to justify.

Safety First Movement

REGARD by employers for the welfare of employes in steel mills and machine shops is emphasized by the constant progress being made in the safety-first movement. Every device that the ingenuity of highly trained men in the great safety departments of steel companies and machine shops can contrive is pressed into use. These devices are not only physical mechanism attached to machinery to protect employes from injury or death. They embrace a thorough schooling of the minds of workers. The appeals are made to them through innumerable signs admonishing them to be careful and alert that they may avoid danger. Lectures and personal talks are held to impress upon the workers the fact that they owe it to their families, themselves, fellow workers and their employers to be cautious. Moreover they are trained in the direction of sanitation.

It has been a most insistent work; discouragements have been met and overcome and new ones have risen and will be met successfully. Strange as it may seem it has been difficult to get many employes to look after their own welfare. Results obtained, however, have more than justified the safety-first campaign. When statistics, showing the number of accidents and deaths in steel mills and machine shops for this year, have been compiled it is confidently believed they will indicate a marked decrease as compared with previous records. This is most gratifying in view of the fact that there has been a decided decline in the number of fatalities and accidents each year since the safety-first movement was begun. The cases of physical exhaustion of employes are comparatively few this summer despite the extreme hot weather that prevailed at times in some of the steel districts. La Belle Iron Works, Steubenville, O., reports that there has not been one instance of physical exhaustion in its mills this summer. No doubt this remarkable showing is partly due to the excellent cooling system that company has installed.

The psychology of the safety-first movement is well summed up in the concise words found on a placard at the entrance to the Illinois Steel Co.'s works at Gary, Ind. It carries real food for thought and unquestionably has inspired constructive ideas. It reads:

The careful man is usually efficient,
The careless man is not.

Emigration and Welfare Work

GOVERNMENT statistics show that for the year ending July 1, 1915, the number of immigrants arriving in this country was the smallest since 1899. The net increase in the foreign population was less than 48,000. It is probable that the departures since Italy entered the war will greatly decrease the net gain in foreign population, if indeed they do not entirely wipe it out; for it is certain that Italians in large numbers have been leaving this country during the past few weeks. It would not be at all surprising if the six months ending Jan. 1, 1916, showed a decided loss in foreign population in this country.

This means that if iron, steel and other industries continue to operate at the present rate or to the full employing capacity, there will be a serious labor shortage in this country. It will be well for manufacturers to look this prospect squarely in the face and discourage emigration to native lands by increasing wages as rapidly as business will justify and by making certain kinds of labor more attractive. Other things being equal, the companies which make it possible for employes to take shower baths and change their clothes before starting for their homes will attract and hold a better class of labor than will concerns from whose plants workmen must go with soiled clothes. This is one of the most practical forms of welfare work, as has been shown by the Reading Steel Casting Co. and other companies.

Prices Present and Past

Quotations on leading products August 25, average for July, 1915, average for May, 1915, and average for August, 1914. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices Aug. 25, 1915.	Average for July, 1915.	Average for May, 1915.	Average for Aug., 1914.
Bessemer pig iron, Pittsburgh..	$16.45	$14.88	$14.55	$14.90
Basic pig iron, Pittsburgh.....	15.45	13.88	13.45	13.90
No. 2 Fdy. pig iron, Pittsburgh	15.45	13.60	13.45	13.90
Northern No. 2 Fdy., Chgo....	13.50	13.00	13.00	14.00
Lake Superior Charcoal, Chgo..	16.25	15.55	15.25	15.75
Mall., Bess., Chgo.....	13.50	13.00	13.00	14.00
Southern No. 2, Birmingham...	11.50	9.75	9.50	10.00
Southern Ohio No. 2, Ironton..	14.00	12.75	12.75	13.50
Basic, eastern Pa.....	15.50	13.85	13.25	14.00
No. 2X Virginia furnace.....	12.75	12.50	12.50	12.50
No. 2X foundry, Philadelphia..	15.50	14.40	14.25	14.75
Ferro mang., Balti., (prompt)..	110.00	101.20	100.00	125.00
Bessemer billets, Pbgh.....	23.00	21.40	19.50	20.00
Bess. sheet bars, Pbgh.....	24.00	21.70	20.00	21.00
Open-hearth sheet bars, Pbgh..	25.00	22.00	20.00	20.20
Open-hearth billets, Pbgh.....	24.00	21.50	19.50	19.30
Steel bars, Chicago.....	1.49	1.46	1.39	1.36
Steel bars, Pittsburgh.....	1.30	1.26	1.20	1.175
Iron bars, Philadelphia.....	1.40	1.20	1.17	1.20
Iron bars, Cleveland, local del'y.	1.25	1.20	1.15	1.20

	Prices Aug. 25, 1915.	Average for July, 1915.	Average for May, 1915.	Average for Aug., 1914.
Iron bars, Chgo. mill.....	$1.25	$1.20	$1.15	$1.07
Beams, Chicago	1.49	1.46	1.34	1.36
Beams, Pittsburgh	1.30	1.26	1.20	1.175
Beams, Philadelphia	1.509	1.359	1.359	1.30
Tank plates, Pittsburgh.....	1.30	1.22	1.125	1.16
Tank plates, Chicago.....	1.49	1.39	1.29	1.36
Tank plates, Philadelphia.....	1.509	1.359	1.359	1.30
Sheets, blk., No. 28, Pbgh.....	1.85	1.77	1.80	1.88
Sheets, blue an., No. 10, Pbgh.	1.40	1.35	1.35	1.375
Sheets, galv., No. 28, Pbgh....	3.75	4.55	3.40	2.85
Wire nails, Pittsburgh.....	1.65	1.59	1.55	1.55
Connellsville fur. coke contr...	1.75	1.67	1.65	1.80
Connellsville fdy. coke, contr...	2.25	2.25	2.25	2.36
Heavy melting steel, Pbgh.....	14.00	11.75	11.75	11.50
Heavy melting steel, east'n Pa.	14.00	12.00	11.31	10.50
Heavy melting steel, Chgo.....	11.50	10.15	9.25	9.50
No. 1 wrought eastern Pa.....	15.50	13.00	12.50	12.50
No. 1 wrought, Chgo.....	10.75	8.90	8.75	8.75
Rerolling rails, Chgo.....	12.25	10.00	10.00	11.25
Car wheels, Chgo.....	11.75	10.30	9.75	11.00

(For Additional Prices See Page 416.)

Pig Iron is Bought Heavily in East

Prices Continue to Advance and Large Users Make Inquiry for Next Year's Needs

New York, Aug. 24.—Sales of pig iron in this district the past week total at least 40,000 to 50,000 tons. The largest lot was 20,000 tons of low silicon for first half taken by an eastern iron mill from two Buffalo producers, at $14, furnace. Pending inquiries including the 10,000-ton or so lot of basic for a New England buyer, which still is open, aggregate a good tonnage. These figures, however, are not as large as during the several weeks preceding and the market, while active and strong, is less excited. Much of this is due to the deliberate action of many producers in making up their minds what advance to quote for shipment after Jan. 1. Eastern Pennsylvania makers have not generally announced their schedules though in one case, $16.50, furnace, for No. 2X for first half was named, or about $1.50 over the current market. Buffalo furnace interests sold a good tonnage for next year at $14, furnace, but prices have been advanced to $14 for spot and $14.50 for last and first quarter. Central Pennsylvania makers have gone to $15, furnace, for No. 2X for first half. For this years, the tidewater market is $15.50 to $16.00, for No. 2X. Lake Superior charcoal now is $16.25, Buffalo, for base grades for this year and $16.75 for first half. Some of the speculative iron recently purchased in large lots is beginning to come out and resales of such metal reach 10,000 to 15,000 tons, on which a good profit was netted. This iron is not disturbing the market, however, as little of it is being offered to consumers and is mainly handled through middlemen. Southern iron in speculators hands was offered to dealers within a few days at $11, Birmingham. Some consuming sales of the week include 1,500 tons of 2X and 2 plain to an Elizabeth buyer; and 5,000 tons of foundry for first half, to a New York state equipment maker.

Some new inquiries are 2,000 tons of high silicon and 1,000 to 2,000 tons of foundry for two buyers for western plants; 3,000 to 4,000 tons of low silicon, first quarter, for a New Jersey pipe maker, and others. Export inquiries include 1,500 tons of foundry for Holland, 3,000 tons of steel-making for France and some for Japan. The Port Henry furnace is resuming this week.

Slow to Quote Next Year

Philadelphia, Aug. 23. — Hesitancy among both buyers and sellers to act on the market after Jan. 1 has reduced the volume of pig iron sales in this district from the recent active movement. Conditions are very strong, however, and the doubt only concerns the amount of the advance that will be asked for first quarter and first half. Consumers, especially steel makers seem more willing to buy for next year than the furnaces to sell, the latter's reluctance being due to their uncertainty over ore, coke and labor costs for that period. There remains considerable interest in basic, both for this year and next. Several thousand tons additional of this grade have been sold for third and fourth quarter shipments at $15.50, delivered, an unchanged price. On another lot of 5,000 to 10,000 tons for this year $16, delivered, was quoted. The latter now seems to be the minimum figure for delivery by January. Makers have not yet reached a conclusion as to what price to quote for first quarter and first half for which two consumers are tentatively inquiring, but it probably will be not less than $16, furnace, or about $16.75, delivered, on the average, and it may be considerably higher. Standard low phosphorus has advanced about $1 further. Sales of several thousand tons have been made at over $23.50, delivered, to a buyer here, who

(*For complete prices see page* 416.)

recently has taken about 10,000 tons for this year. Some makers now ask $24, Philadelphia, and an offer of over $23, Philadelphia, was refused this week. Lebanon grades remain at $18 to $18.50, furnace. Pennsylvania foundry irons have risen about 50 cents further and the Philadelphia market for the balance of the year is $15.50 to $16, for No. 2X. Not much metal can be had at the lowest figure, but some is available at $15.60. Sales at about $15.65, delivered, are noted. These prices figure back a furnace minimum for No. 2X of $15 with $14.75 asked for No. 2 plain. Some makers are asking more. Sales of pipe forge at $15, delivered were made this week and the same figure is offered by buyers. These lots included 1,000 tons of Virginia iron at about the delivered price given. Active Virginia sellers at $12.50, furnace, for No. 2X for this year have withdrawn that figure for $12.75 and will only sell lightly at the higher schedule. Alabama makers are going slowly in quoting for first quarter and half and are declining to name prices on inquiries here for about 5,000 tons. The Pennsylvania railroad bought 5,000 tons or more of coke and charcoal for shipment this year to Altoona. It took more iron than its inquiry called for. The Norfolk & Western which usually buy about 4,000 tons every six months is out for first half.

Pig Iron Demand Continues Heavy

Pittsburgh, Aug. 24.—Following a brief lull, which extended over six or seven days, the pig iron market in western Pennsylvania and eastern Ohio again is moderatively active. Prices of all grades continue their march toward higher levels, and it is not improbable that additional blast furnaces will be blown in in the next few weeks. One of the more prominent Shenango valley blast furnace interests today is shipping 34 carloads of bessemer iron by special train to the eastern seaboard to catch a vessel sailing for Italy on Thursday. Several fairly large lots of bessemer iron, one of which involves 2,500 tons, have been sold to domestic consumers at $15.50, valley; that figure appears to represent the lowest price at which this grade is obtainable for prompt delivery. Most dealers are refusing to sell steel-making irons for extended shipment. It is reported that 10,000 tons of basic iron have been purchased at $14.25, valley, but this report lacks confirmation. Foundry grades reflect strength; No. 2 foundry and malleable are commanding $14.50, valley, and gray forge iron has sold at $14, valley. Some foundry iron tonnage for shipment after Jan. 1 has been sold at $15, valley. The Westinghouse Electric & Mfg. Co. has opened negotiations for second and third quarter foundry iron requirements for its plant at Cleveland.

Buffalo Prices Advance

Buffalo, Aug. 24.—Another week of sales amounting to 40,000 to 50,000 tons, marks the activity of the furnaces in the Buffalo district, and prices have again been advanced. Realizing that the foundry situation is strengthening, that specifications for iron under contract are coming in in greater volume, and that the supply of foundry irons will be considerably reduced by stacks turned over to the production of steel-making grades, producers are working the prices up to $15, which may become the minimum instead of the maximum within a few days.

Higher Prices at Cleveland

Cleveland, Aug. 24.—At least one prominent seller has established a minimum price of $15, Cleveland furnace, for No. 2 foundry for delivery during the balance of this year and the first half of 1916. This indicates the strength of the market, although some furnace interests are still willing to accept $14.50 for shipment until Dec. 31. Inquiry, however, for iron for the remainder of 1915 is very light, most of the sales made during the past week being for late winter and early spring delivery. It is estimated that from 30,000 to 40,000 tons have been sold in the Cleveland district recently for the first half of next year. Basic and malleable tonnages are available at $14.50, furnace.

Pig Iron Active

Chicago, Aug. 24.—The pig iron market in the Chicago district the past week developed considerable activity, which was particularly applicable to northern grades. Inquiries involving quantities up to 3,000 tons are pending and one sale of 3,500 tons of northern iron was closed. One inquiry, which originally called for 1,000 tons of northern No. 2 foundry, has been increased to 3,000 tons. Malleable and basic are equally as active. While some prominent dealers are asking $14 for prompt delivery, the minimum of $13.50 has not disappeared. Makers are somewhat reluctant to quote on first half iron and are asking a range of $14 to $14.50 for that delivery. Good demand exists for southern iron and the situation has been improved by reason of better foundry activity, denoted by increased coke shipments. Some makers are asking $11.50, Chicago furnace, for southern iron for prompt shipment, but sales at $11 are being made. Jackson county silveries, 8 per cent silicon, are now held at $16.25 to $16.50, Chicago furnace. The Illinois Steel Co. has blown in E furnace at South Works, Chicago, and No. 2 furnace at Joliet, Ill. All of the company's eight furnaces at Gary, Ind., 11 at South Works, and four at Joliet, now are in blast, or a total of 24 of its 25, one being off in Milwaukee.

(*For complete prices see page* 416.)

Inquiring at St. Louis

St. Louis, Aug. 24.—The pig iron market in this district has improved and scattering inquiries aggregate 3,000 tons. Southern No. 2 is held at $11 to $11.50, Birmingham.

Southern Iron Firm

Birmingham, Ala., Aug. 23.—In spite of the large sales made during the past four or five weeks, the iron market continues active. Inquiry is strong, No. 2 foundry being held at $11 to $11.50, and one producer is quoting $12.50 for 1916 delivery.

Bessemer Pig Advances

Youngstown, O., Aug. 24.—Iron producers in this district have made sales of bessemer iron at $15.50, valley, but it is probable no more is available under $15.75. No. 2 foundry has been sold at $14.75 for this year's delivery, and the market is firm at $14.50 for the last half. Malleable also is strong. A range of $14.25 to $14.75, valley, represents the market for these grades. It is not believed any basic iron is obtainable under $14.50 for the last half. However no sales have been reported of foundry, malleable or basic at the $15 level for early next year delivery recently suggested by Cleveland makers. While recent buying was heavy, inquiries continue to come out in good volume, largely for the first half of next year.

Sales Show Decrease

Cincinnati, Aug. 24.—Sales and inquiries are dwindling materially, but the market has lost none of its strength. Prices are stationary, but firm at the level to which they were advanced last week. The falling off of sales is attributed to the fact that by far the majority of melters in this territory have bought for last half requirements, and first half prices, especially those on southern iron, are almost prohibitive. A good demand has developed during the past few days for low phosphorus iron, in spite of an advance recently of about $5 a ton on this grade. All but two southern furnaces have declared them-

selves to be out of the market for the last half, and are holding small lots for the first quarter at $12.50, Birmingham, for No. 2 foundry. The prevailing price for the last half is $11.50, Birmingham, for this same grade. Little iron has been sold at first quarter quotations. Southern Ohio No. 2 foundry is quoted at $14 for the last half and $14.50, Iron-ton, for the first half. Silvery iron is held at $16.50 for the last half, and $17, furnace, for the first half, for 8 per cent silicon.

Spiegeleisen Demand

Large Tonnage Under Inquiry for Six-Months Delivery

New York, Aug. 24.—Present indications are that there will be no renewal of shipments of ferro-manganese from England to the trade in this country before October. One agent of English makers has been advised that loading will start about the middle of September, which signifies that deliveries may be expected about the first week in October. This tonnage will apply against running contracts of American consumers. The amount of the shipment is not specified so that it is not known that the tonnage to be delivered will be as large as that which was being received before the present restrictions were imposed. With the continued delay in English deliveries, the spot market for ferro-manganese is advancing.

Several domestic producers, with surplus to offer, will not sell at present except at considerably higher prices. A sale of 50 tons of spot English by a middleman at $110, seaboard, is noted. On some inquiries, $140, seaboard, was named by holders of limited amounts of English metal. Small lots of lump and ground material continue to be sold on the basis of about $140 at the seller's plant. For France, 200 tons has been asked, which apparently is for re-export.

Foreign manganese ore now is quoted at about 42 cents per unit, tidewater. A recent sale of a cargo of Indian ore to a Pennsylvania steel company was made on this basis and a cargo of Brazilian ore has been offered at this figure. One independent steel company, which has been buying manganese ore freely for some months, now is credited with having more than 20,000 tons in stock.

Spiegeleisen is quite active. Several sales totaling 4,000 tons of domestic were made and a western Pennsylvania steelmaker took 1,000 tons. Some further sales for export are reported. An important consumer is inquiring for a large block of some thousands of tons to be shipped over the next six months. The domestic price remains at $26, furnace, for 19 to 21 per cent. English spiegeleisen has been quoted at $40, seaboard, a figure which puts it completely out of competition. Spiegeleisen at $26, furnace, for 20 per cent, which contains about 75 per cent of bessemer iron, shows a cost of about 74 cents per unit of manganese as compared with $1.22 per unit for 80 per cent ferro-manganese containing 15 per cent bessemer iron at $100, seaboard. France has been a buyer of bessemer ferro-silicon in this country and is credited with having taken several thousand tons.

Alloy Demand Brisk

Pittsburgh, Aug. 24.—Sellers of 80 per cent ferro-manganese in the Greater Pittsburgh district have had no direct advice regarding the price of English material, but this alloy has been offered here at $110, seaboard, the last few days. Eastern dealers have quoted as high as $140, seaboard. Demand for other alloys is heavy and manufacturers of high-speed tool steel have experienced difficulty in covering alloy requirements. The following are current prices of ferro-alloys and metals for steel-making: Ferro-chrome, 4 to 6 per cent carbon, about 20 cents a pound; 2 per cent carbon, 40 cents per pound; ferro-vanadium, $2.25 to $2.30 per pound, of contained vanadium; nickel, 52 cents a pound; ferro-silicon, $75 per ton for 50 per cent in small lots; ferro-carbon titanium, 8 to 12½ cents per pound in carload lots; ferro-tungsten, nominally quoted at from $3 to $3.50 per pound of contained tungsten; cobalt metal, $1.60 to $1.75 per pound, and aluminum, 36 cents per pound, New York.

Pipe is Quiet

Recent Decline Does Not Stimulate Buying

Pittsburgh, Aug. 24.—No large orders for iron or steel pipe have been placed this week. Inquiries for about 200 miles of line pipe for the J. G. White Corporation, New York, still are pending and it may be several weeks before any definite action is taken by the White corporation. Some observers express the belief that black pipe will be advanced shortly; the future price of galvanized tubular products will be governed largely by the market for spelter. Locomotive boiler tubes are fairly active, but merchant boiler tubes are quiet and irregular.

(For complete prices see page 416.)

Ore Shipments

Are Increasing But Sales Are Limited

New York, Aug. 24.—Eastern Pennsylvania furnaces have been buying Lake Superior ores more freely during the past several weeks. Several transactions involving good tonnages, have been closed. One consumer doubled the amount of a previous large order. Mesabi non-bessemer ores at the full schedule, are equivalent to about 7.57 cents per unit, delivered eastern Pennsylvania, which is the lowest figure that any standard ore in quality can be obtained. Trans-Atlantic ore, under present conditions, continues out of competitive range with the lake mineral. This is illustrated by the offering to eastern consumers of Algerian bessemer ore, 54 per cent natural, at 7 cents per unit, tidewater, based on a 10s freight. Inasmuch as the actual freight from Algeria at present, is 13s to 14s, this quotation means from 8.34 to 8.78 cents per unit, f. o. b. tidewater, to which must be added a cent a unit on the average, for the freight to eastern Pennsylvania furnaces.

Ore Shipments Increase

Cleveland, Aug. 24.—The ore market has quieted down, following the recent burst of activity. It appears now that most of the furnace interests are well covered, although sellers look for additional buying for late fall shipment, due to the fact that ore prices will very probably be advanced next year. A considerable tonnage of Mesabi ores, both bessemer and non-bessemer, is available. Ore shipments down the lakes are increasing steadily and it is believed the season will wind up with a flourish.

Advance Warehouse Prices

Chicago, Aug. 24.—The Illinois Steel Co. made an advance of $1 per ton in warehouse prices on shapes, plates and bars. Steel bars now are quoted at 1.75c base and structural shapes and plates at 1.85c. This makes the price in St. Louis 1.80c on bars and 1.90c on shapes and plates, and in St. Paul, 1.85c on bars and 1.95c on structural shapes and plates.

The Sterling Wheel Co., 245 Oregon street, Milwaukee, manufacturer of ball-bearing resilient wheels for automobiles and motor trucks, which recently was reorganized and the name changed from T. S. Wheel & Mfg. Co., with W. M. Swift Miller, Milwaukee, as president and general manager, is building a plant at Eighth and Oklahoma avenues.

Shrapnel Bars Go Begging

Additional Tonnage Offered Mills, But Cannot Make Delivery—Domestic Demand Improves

Philadelphia, Aug. 23.—Sellers in this territory continue to figure on some large inquiries for steel bars and forgings for explosive shells, some of which have been newly offered. The Baldwin Locomotive works has inquired for 17,000 to 18,000 tons of 3¼ rounds or squares for delivery over about 12 months. A Wisconsin machinery builder who has a shell contract, this week asked 7,500 tons of 3¼-inch rounds of eastern Pennsylvania mills. Another lot of 1,350 tons of rounds, 80 and 100 millimeters size, French specifications, for an eastern Pennsylvania steel company is current. Eastern Pennsylvania bar makers also have a direct inquiry for 160,000 tons for the French government which has been referred to before and it is believed action will be taken soon on 24,000 tons for a company in this district which has been out for several weeks. Makers in this territory are holding large rounds firmly at 2.50c to 3.00c, mill, but a large producer outside this district, who recently put its rail mill to the rolling of these bars, has been quoting around 2.25c, mill. Outside of shell requirements, bar orders are active. Makers report the largest specifications the past week of any similar period yet, from buyers in this territory, practically all of which is distinct from war business. Some mills name deliveries at eight to ten weeks. Prices are firm at 1.35c, Pittsburgh, or 1.509c, Philadelphia, for third quarter, but the mills are not active in selecting business and with some of them this figure is purely nominal.

Heavy Inquiry for Shrapnel Bars

New York, Aug. 24.—France continues to inquire either direct or through American engineers for some enormous additional lots of shell bars. These are reported in various figures, 100,000 tons, 160,000 tons, etc., according to the amounts that have been placed before different makers. It is known the total may be as much as 300,000 tons divided into 50,000 tons monthly for the first six months of 1916. The market still is flooded with many other inquiries for similar material from shell makers. Very little free tonnage in large rounds remains for this year's delivery.

War Orders Predominate

Pittsburgh, Aug. 24.—Heavy buying of steel bars for the manufacture of war material continues. A representative of an English firm has been in Pittsburgh this week, asking bids on about 5,000 tons of finished material, and agents for other belligerent European nations are purchasing practically all the tonnage available for quick delivery. Shipments of larger sizes of rounds are deferred three months in some instances. Specifications from agricultural implement makers, nut, bolt and rivet manufacturers and shafting interests are heavy. Iron bars are being held at 1.30c, although premiums are being paid for refined stock.

Iron Bar Market Strong

Chicago, Aug. 24.—The iron bar market is improving, specifications on contracts being more numerous and more buying is reported by the railroads, bolt and car makers. The situation also is helped by the firm tone of the scrap market and the scarcity of steel bars. Quotations are firm at 1.25c, Chicago mill.

Steel Bars Extremely Strong

The steel bar market continues strong and large mills at Chicago are filled for the remainder of the year. Specifications against contracts are large, particularly by implement makers. Some fair tonnages were sold at 1.49c, Chicago. The market, however, shows an upward tendency and some mills are asking 1.54c, Chicago, following the action of the Carnegie Steel Co. in increasing the price to 1.35c, Pittsburgh. The Inland Steel Co. made formal announcement on Saturday of the new quotation of 1.35c. This company, however, is well filled up for the remainder of the year and its figure is largely nominal. The Corporation mills also are asking that figure. Hard steel bars have been advanced to 1.30c.

Bars from Warehouse Advanced

Cleveland, Aug. 24. — Warehouse prices in the Cleveland district have been advanced sharply on rolled products and a premium of $5 a ton has been placed on bars over 2 inches. The demand for bars from 3½ to 5 inches, suitable for shells, is so heavy that the selling interests have felt justified in asking an extra price for these sizes, particularly since warehouse orders are showing a decided tendency to increase, due to delayed deliveries from the mills. On account of the huge demand for artillery ammunition, the market continues unusually active and mill deliveries are far advanced. Prices are firm, the leading interest and several important independents quoting strictly on the basis of 1.35c, Pittsburgh. This price is available only for shipment during the next 60 days, no contracts being made for longer periods. Specifications are heavy.

(*For complete prices see page* 416.)

Bar Mills Rushed

Buffalo, Aug. 24.—The demand for bars is greater than has been experienced by the mills in many years. Activity is not confined to war orders, but extends into general lines. Deliveries on bars now are deferred to a range of four weeks to 90 days. With one exception the mills are holding firmly at 1.35c, Pittsburgh, and a further advance in warehouse prices has been reported.

Strong and Active

Philadelphia, Aug. 24.—The bar iron market continues strong and more active in eastern Pennsylvania. Prices are firm at 1.409c, Philadelphia, or 1.25c, Pittsburgh. In some cases, higher prices are being obtained, a lot of special bars having brought 1.80c, Philadelphia.

Hoops, Bands and Shafting

Pittsburgh, Aug. 24.—The Columbia Steel & Shafting Co., the Union Drawn Steel Co., the Jones & Laughline Steel Co. and the Republic Iron & Steel Co. have advanced quotations for cold-rolled shafting $1 a ton and are now asking 64 per cent off the list for carload tonnages. Most shafting interests will operate plants at capacity for five or six months, unless orders are cancelled. Consumers of shafting, particularly those making machinery, are specifying briskly. Hoops are being held at 1.40c and bands at 1.35c.

Nuts, Bolts and Rivets

Chicago, Aug. 24.—Firmness characterizes the market for bolts and nuts. Mills are well filled and the situation has been helped by increased purchases by agricultural implement makers. Structural rivets are quoted at 1.75c and boiler rivets at 1.85c in carload lots.

C. M. Power, general sales manager of the Standard Chain Co., Pittsburgh, has closed a contract with the lighthouse department at Tompkinsville, N. Y., for all of its chain requirements for the fiscal year 1915, amounting to 1,000,000 pounds. All of the chain will be especially adapted for lighthouse service.

Blue-Annealed Advanced

Black Sheets Firmer and Additional Mills Prepare to Furnish Galvanized Material

Youngstown, O., Aug. 24.—Recent strength and rising prices in the spelter market are an unsettling factor in the sheet market. Just as galvanized sheet prices were getting away from their almost prohibitive high levels, and sheet producers were beginning to entertain hopes of a revival of buying the decline in spelter was checked and the market turned upward. However, there have been so many flash-in-the-pan movements in spelter that producers and consumers alike are at sea. Some fair buying of galvanized sheets has been done at 3.60c to 3.75c for No. 28 gage, Pittsburgh base, and quotations as low as 3.50c, Pittsburgh, have been heard in the valleys. Demand for black sheets from the manufacturing trade is good. The supply of this material has been heavy, but increasing sheet bar costs are influencing quotations upward. Most of the larger valley interests are quoting 1.90c, although the 1.85c level has not disappeared. Blue-annealed sheets are relatively in better demand than the other grades. Producers state that a range of 1.40c to 1.50c for No. 10 gage, Pittsburgh, represents the market, but some makers are holding for 1.45c. A level of 1.50c for blue-annealed is above the parity with box-annealed sheets of the same gage, which is probably the reason blue-annealed sheets are no higher. Sentiment in the sheet trade is improving. It is felt that a large amount of business has been held back in galvanized that must come out sooner or later, and delayed profits realized. Some mills are getting business for export to South America, the West Indies and Canada, and are enthusiastic over the opportunities thus presented. The South American business has consisted largely of 3-inch corrugated roofing of the heavier gages, while Canadian buyers are placing orders for the same classes of material used largely in this country.

Sheet Prices Advance

Pittsburgh, Aug. 24.—The American Sheet & Tin Plate Co. last week advanced its minimum price for No. 10 gage blue-annealed sheets to 1.40c, and that figure now represents the bottom of the market. Some mills are asking 1.50c, base, for blue-annealed products. Several makers have advanced the price of black sheets $1 a ton, and now are asking 1.90c for No. 28 gage. Galvanized products are irregular as the result of the downward tendency of the spelter market. Some mills have sold galvanized sheets at slightly less than 3.75c for No. 28 gage, but the general market is represented at a spread from 3.75c to 4c, base. Practically all the galvanizing sheet mill capacity made idle by the abnormally high price of spelter has become engaged the last two or three weeks. Domestic demand for all grades of sheets is fairly heavy and numerous inquiries for export have been received recently. Mills are operating at from about 75 to 85 per cent of capacity.

Sheets Are Fairly Active

Cleveland, Aug. 24.—The sheet market is moderately active. Although spelter prices remain weak, no reduction has been made on the Cleveland warehouse price of 4.50c to 5c for No. 28 galvanized. No. 28 black and No. 10 blue annealed sheets remain at 2.45c and 2.05c, Cleveland warehouse, respectively. Special sheets suitable for automobile bodies, etc., are in better demand than ordinary material.

Sheet Market Irregular

Chicago, Aug. 24.—Sheet prices are irregular, inquiry for galvanized being light, although the mills are operating at capacity, filling old contracts. Some improvement in operations is noted as a result of the decline in the price of spelter. Some makers are quoting galvanized sheets, No. 28 gage, at 3.69c, Chicago, although 3.79c occasionally is asked. Producers believe buying will improve when zinc reaches a normal level. The Inland Steel Co. has re-entered the galvanized sheet market. Blue annealed sheets No. 10 are quoted at 1.59c, Chicago. Specifications and inquiry are good. Light demand prevails for black sheets, although the market is firm at 2.04c for No. 28 gage.

Quote Blue Annealed High

Philadelphia, Aug. 23. — Unusually high prices for semi-finished steel and the continuation of a heavy demand for sheets is leading eastern Pennsylvania mills to make further sharp advances in the latter product. Some of the most important of these producers now quote No. 10 gage, blue annealed, for the balance of the year, at 1.60c to 1.75c, Pittsburgh, or 1.759c to 1.909c, Philadelphia, and have made good sales even at the maximum. At present 1.60c, Pittsburgh, is their minimum price. Other eastern Pennsylvania sheetmakers are not quite so strongly fixed, but 1.45c, Pittsburgh, or 1.609c, Philadelphia, is as low as is being named. Specifications are active.

Sheet Sales Light

Cincinnati, Aug. 24.—Sales of sheets are not very good, due to the refusal of mills to quote for contract delivery. This is true especially on galvanized grades, because of the uncertainty of the price of spelter. Galvanized sheets are a little weaker now, being quoted at from 3.65c to 3.75c, Pittsburgh basis. Black sheets are steady at 1.80c, Pittsburgh.

(*For complete prices see page* 416.)

Cast Iron Pipe

Gas Companies Make Inquiry for 1916 Requirements

New York, Aug. 24.—Gas companies have been inquiring for good lots of cast iron pipe from eastern shops for next year's delivery. While the foundries are not inclined to quote so far ahead, in view of the uncertainties over raw material costs, etc., where they are pressed, they are naming a sharp advance. The market is not very active on the side of public lettings but private buying holds up well. That American makers may expect keen competition from English shops in the South American trade, is shown in the placing of 200 tons for Brazil. The English producers quoted the same price delivered as the American foundries did at New York. This is equivalent to $5 a ton or more under the American price when the freight is added. The United States Cast Iron Pipe & Foundry Co. bid $27.30 for the 4's; $24.80 for the 6's and 8's and $23.80 for the 10's, 12's and 14's on the 3,500 tons for Watervliet, N. Y., upon which it is the low bidder. Newbury, Vt., took bids this week on 425 tons of 4's to 12's and Boston on 525 tons of 4's to 8's. Yorkville, Pa., is inquiring for 275 tons of 4's to 6's and Wellsville, N. Y., still figures on a fair tonnage.

Cast Iron Pipe Market Stronger

Chicago, Aug. 24.—The cast iron pipe market is stronger and an advance in prices is not improbable. Inquiry is fairly good, and the extremely firm tone of the pig iron market has strengthened the cast iron pipe situation. Four-inch pipe continues to be quoted at $26, Chicago, and 6-inch and larger, $24. Sparta, Ill., will award 650 tons of 6 to 8-inch pipe today and Chariton, Ia., at the

same time will let approximately 400 tons of 4 to 10-inch pipe. Maumee, O., will award 800 tons of 4 to 11-inch pipe on Aug. 28. Wittenberg, Wis., is about to let 200 tons of 6 to 8-inch pipe, and Minneapolis, on Aug. 28, will award approximately 1,100 tons of 24, 30 and 36-inch pipe.

Ship Plates Are in Demand

Two Additional Boats Requiring 8,000 Tons of Steel Placed With Eastern Yards

Philadelphia, Aug. 23.—Demand for plates upon eastern Pennsylvania mills still is growing and the situation is becoming more congested as to deliveries. Some makers report they can accept practically no more tonnages for this year; others can ship nothing this quarter, as their deliveries run to six to seven weeks. On such shipments as can be made for third quarter, 1.35c, Pittsburgh, or 1.509c, Philadelphia, is the firm general price. Higher is obtained on small lots for quick delivery. Not all makers will quote on fourth quarter contracts. Some continue to do so at 1.45c, Pittsburgh, or 1.609c, Philadelphia, and one mill took a small tonnage at 1.50c, Pittsburgh. Universal plates, which have been rather slow, now are being ordered very freely, indicating a better activity in bridge and structural work. Marine trade is very active. The New York Ship Building Co. has closed for two more tank steamers, requiring about 8,000 tons of steel, which will be furnished by Pittsburgh mills. The Cramp yard has received a second tanker for the Sun Art Co., about 4,000 tons, and a car ferry for the Florida East Coast railway, 3,500 to 4,000 tons. This steel will come from eastern and Pittsburgh mills. These awards increase the number of merchant vessels ordered of eastern yards to 55 or 56.

Ask Destroyer Bids

New York, Aug. 24.—Bids are to be received by the government Oct. 6 on six torpedo-boat destroyers, which will require about 3,000 tons of steel, chiefly plates. Plates are strong at 1.35c, Pittsburgh, or 1.419c, New York, with most producers some weeks behind in deliveries.

Plate Market Fairly Active

Chicago, Aug. 24.—Only moderate activity is shown in the plate market. The mills of the leading producers, however, are filled, but some independents are in position to take attractive tonnages. Specifications against contracts are more numerous. The Inland Steel Co., which has advanced prices on shapes and bars to 1.54c, Chicago, continues to quote plates at 1.49c. This figure is shaded where large tonnages are involved.

Plate Situation Improved

Cleveland, Aug. 24.—The northern Ohio plate mills are still willing to accept 1.25c, Pittsburgh, for desirable specifications. It is believed, however, that this price will disappear shortly, owing to the filled-up condition of eastern producers, many of whom have advanced their quotations to 1.35c, Pittsburgh base.

Demand Improves

Buffalo, Aug. 24.—The demand for plates is improving. Small eastern mills which have been making concessions until recently, now are asking slight premiums for prompt shipment.

Plates Held at 1.35c

Pittsburgh, Aug. 24.—Independent mills have adopted the 1.35c quotation for steel plates, following the lead of the Carnegie Steel Co. While some material has been sold at this price, some irregularities continue to be reported.

Wire Prices Are Advanced

Galvanized Products Reduced and Spread Between Plain Wire and Nails Decreased

Pittsburgh, Aug. 24.—The American Steel & Wire Co., Aug. 21, announced new prices, involving an advance of $1 a ton for nails and $2 a ton for plain wire, polished staples and painted barb wire. Quotations for galvanized plain wire, galvanized staples and galvanized barb wire were reduced $2 a ton, net, as a result of declines registered by spelter the last few weeks. Galvanized nails were reduced $5 a ton. The galvanizing extra now is 60 cents, as against the previous extra of 80 cents per 100 pounds. The prevailing galvanizing extra is $6 a ton above that in effect before spelter started its skyrocketing performance. The spread between wire nails and plain wire has been reduced from $4 to $3 a ton. The range between these two products had been $4 a ton for six years. Domestic demand for wire is relatively heavier than that for nails. Inquiries for all kinds of wire products for export involve heavy tonnages. Some of the barb wire to be shipped to European war zones is being painted either gray or green, for obvious reasons.

Advance Stimulates Market

Cleveland, Aug. 24.—The new prices on wire, which were announced Saturday, have stimulated the market and inquiry, particularly for barb wire for export, continues brisk. The new quotations show an advance of $1 a ton on nails and $2 a ton on plain wire, with a decline of $2 a ton on galvanized barb wire, owing to the weakness in spelter. The new prices cover orders for shipment only during September and October. Leading manufacturers report a good domestic demand, except for nails, the specifications for manufacturers' wire being particularly heavy. Cold-drawn stock is also very active. Fair sales of wire rods are being made at $28, Pittsburgh.

(For complete prices see page 416.)

Export Demand Heavy

Pittsburgh, Aug. 24.—Numerous inquiries for tin plate for shipment to South American countries and the far east have been received this week. The domestic market is seasonably quiet, and prices are unchanged.

Mesta Co. Furnishes Large Press

The Mesta Machine Co., Pittsburgh, recently shipped a 1,500-ton quick acting steam-hydraulic forging press of the four-column type to the Pressed Steel Car Co., Pittsburgh, for heavy forging duty. Among the more important features of the press are the valves which permit the use of a single controlling lever, making it possible to automatically stop the machine at desired points. The intensifier is located directly above the hydraulic cylinder, thus eliminating high pressure piping and giving a more compact working unit.

Steel Scrap is in Demand

All Districts Report Heavy Sales at Advancing Prices

Chicago, Aug. 24.—The iron and steel scrap market in this district is stronger, price advances having been made on practically all grades. Dealers are offering large tonnages, but consumers are well supplied. The Chicago, Rock Island & Pacific is offering 4,100 tons, bids to be opened this week. The largest single item in this lot involves 600 tons of No. 1 railroad wrought. The Chicago, Milwaukee & St. Paul yesterday received bids on 1,800 tons, the largest single lot of which was 500 tons of steel rails, 5 feet and over. The Grand Trunk railroad receives bids this week on 1,400 tons, of which 1,087 tons are steel rails.

Scrap Quiet, But Strong

Pittsburgh, Aug. 24.—The market for old material at Pittsburgh is not so active as it was 30 days ago, but prices continue strong for all grades. Heavy melting steel is held at $15 by some dealers, and low phosphorus scrap, which has been advancing gradually for several months, has commanded as high as $17.50 a ton for plate and shape shearings.

Scrap Prices Advance

Cincinnati, Aug. 24.—A general advance of from 50 to 75 cents a ton has been made on all grades of heavy melting steel. Rolling mills have been taking good tonnages of No. 1 busheling, heavy melting scrap, bundled sheet scrap and No. 1 yard wrought. Jobbing foundries are taking fair tonnages of No. 1 machine cast, but buying from this source has been a disappointment for several months. Stove foundries are barely operating, and are not buying scrap, except in small amounts. While big inroads have been made in dealers' stocks, nevertheless the tonnage in these yards is sufficiently large to prevent a sharp advance.

Buffalo Market Stronger

Buffalo, Aug. 24.—Scrap dealers report an increased demand for heavy melting steel and this grade as well as cast scrap, car wheels and railroad malleable, are held firmly with a tendency toward higher prices. Advances from 50 cents to over $1 a ton have been made in some grades. The leading local consumer of heavy melting steel is in the market for a round tonnage and shipments are being made to consumers in the Pittsburgh and valley districts.

Prices Firm at New York

New York, Aug. 24.—A very strong market is maintained in iron and steel scrap. There is a good demand from both consumers and middlemen, but material is rather difficult to get in quantity because of its being held back for still higher prices. Dealers are moving cautiously in their operations, owing to their inability to get much scrap ahead. For heavy steel, $14, eastern Pennsylvania, is commonly quoted and higher has been offered for ordinary grades. Wrought material is in much demand with $16, delivered, paid for No. 1 railroad and up to $14.50, delivered, for pipe. Re-rolling stock is strong, especially steel axles. Offers of $11.50, New York, for car wheels and $12.25 for No. 1 heavy steel, are noted. The local demand for cast material is not as brisk as in other grades.

Steady Advance Maintained

Philadelphia, Aug. 23.—With the demand strong and the offering of material at the market limited in amount, the steady advance in old material values in eastern Pennsylvania continues. Further sales of heavy melting steel of special quality have been closed at $14.50, delivered, to a steelmaker not in the immediate eastern Pennsylvania district. For ordinary quality the market is $14 to $14.25, delivered. Dealers are offering both figures and sales to middlemen at $13.85, delivered, are noted. The general attitude among the dealers is to cover orders at the market even though they may have to take a loss, as still higher prices are expected. No. 1 railroad wrought has been sold at $15.50 and $16, delivered, and $14, delivered, is the figure freely offered by consumers for wrought pipe. Low phosphorus is strong and is up fully $1 to $17 and $17.50, delivered. Steel axles as well as other grades of re-rolling steel are in active demand both for the home and foreign market. These axles have been sold at $20, delivered, eastern Pennsylvania, and negotiations at a higher figure are pending. Italy is offering 125s. or about $29, delivered, for steel axles, equivalent to about $19, tidewater, and some business probably will result. For steel couplers, knuckles and springs $14.50, delivered, is offered.

(*For complete prices see page* 416.)

Gains at St. Louis

St. Louis, Aug. 23.—Further advances have been recorded in heavy steel scrap and local mills and steel foundries are buying round tonnages. Re-rolling rails and heavy melting steel are difficult to obtain in sufficient quantities to meet buyers' needs. For the first time in a considerable period, local dealers are not considering railroad offerings this week.

Billets

Continue to Advance as Result of Insistent Demand

Philadelphia, Aug. 23. — Continued advance of the prices being paid to eastern Pennsylvania makers for open hearth billets and other forms has put the semi-finished market here on an unusually high plane as well beyond the prices being paid for finished products. The result is some makers of finished steel, who must buy their crude supplies, from time to time, are finding it practically impossible to do so at a profit and sales of finished product by the semi-finished makers themselves also involves some sacrifice on their part, under present circumstances, which have grown out of the scarcity of open hearth steel. Strictly open hearth re-rolling billets are being sold by eastern Pennsylvania makers at $31.50, mill, and upward, or $32 to $33, Philadelphia. One maker quoted $35, mill, on about 2,000 tons, the steel containing nickel and chromium from the ore used and is asking $39, mill, as a base for forging steel. Another producer sold a fair lot of forging steel at $38, mill. Makers in near Pittsburgh territory have been seeking business in this district and have booked 5,000 tons or more. Usually they are quoting $26, mill, for re-rolling and $29, mill, for forging steel, the rate to Philadelphia being about $3, but some tonnage was taken at less. Inquiry for billets, slabs, etc., is fairly good. In view of the lucrative domestic market, little attention continues to be paid to export lots, of which two of 2,000 tons each were offered this week.

Semi-Finished Strong

Pittsburgh, Aug. 24.—An English interest is asking Pittsburgh and Youngstown mills to quote on approximately 22,000 tons of semi-finished material for export to England. Some manufacturers have refused to give this inquiry any consideration, being unable to meet additional obligations. Prices of billets and sheet

bars are strong, but not enough tonnage has been purchased this week to test quotations. Forging billets have sold at as high as $30 a ton. Wire rods are quoted at $27, Pittsburgh.

Sheet Bars Strong

Youngstown, O., Aug. 24.—While the chief producers of semi-finished steel in the valleys have contracted for their output for the most part for the remainder of this year, an occasional small lot is obtainable. Like the pig iron sellers, producers are moving cautiously, seeming to fear a "runaway" market. It is predicted Oct. 1 will see $28 base for open hearth sheet bars and Jan. 1 $30, but, of course, this is mere guesswork. Producers now will accept $25, Youngstown, for open hearth sheet bars, if they happen to have the material for sale, although an unconfirmed report of a sale at $26, Youngstown, is heard. At present consumers are pretty well covered for third and into the fourth quarter. Bessemer sheet bars are quoted $24, Youngstown; bessemer billets, $23, and open hearth billets, $24.

Structural Market Improves

Lettings for Apartment Buildings in New York Total 10,000 Tons—Prices Firm

New York, Aug. 24.—Apartment house building has taken on seasonable activity in this market and not less than a dozen different projects involving about 10,000 tons, are being figured. This is the market's most conspicuous local feature at present as other branches of the building trade remain below normal. Despite the moderate volume of new structural work, the congested position of the mills, especially those in eastern Pennsylvania, shows no signs of easing up and deliveries are being delayed even longer. In quite a number of instances in current business, 1.40c, Pittsburgh, or 1.569c, New York, is being obtained. On large inquiries, 1.35c, Pittsburgh, is named, but this is minimum. Fabricated figures make only slight advances. On pier work in this city, recent contracts were taken at $42 to $43, delivered.

Inquiry Still Heavy

Philadelphia, Aug. 23.—Inability to make anything like prompt delivery on sizeable lots of structural shapes, remains an outstanding feature of the situation among eastern Pennsylvania mills. Various methods are being used to meet the conditions which the continuing heavy flow of orders has forced upon the makers. Some of them now have no open price and will quote only on specific jobs; others will quote only on small lots for the present quarter. As far as can be learned, there is no quoting on fourth quarter contracts. The rate at which tonnage is coming in will give makers a good back log for the last quarter and contracts are not considered very desirable. Deliveries on some sizes are up to eight to 10 weeks and on any considerable assortment four to six weeks. Prices are very strong and show an inclination toward premiums on small current lots. The general market is 1.35c, Pittsburgh, or 1.509c, Philadelphia, but on small pick-ups 1.40c, Pittsburgh, is obtainable without trouble. Fabricating prices still improve slowly. New work here consists principally of small contracts, though an 1,800-ton bank building was let this week.

Demand Increases

Buffalo, Aug. 24.—While activity in structural material is less than that in bars, the mills and agencies in this district report a growing demand. Some sizes now cannot be had until Oct. 1. Prices are maintained firmly at 1.35c, Pittsburgh

Shapes Gain Strength

Pittsburgh, Aug. 24.—Fabricators in this district are enjoying fairly satisfactory conditions, some having enough orders on their books to insure operations for three or four months. Structural shapes are firm at 1.35c. The Riter-Conley Mfg. Co. will furnish 6,000 tons of fabricated material for an office building at Washington for the department of the interior.

Structural Market Quiet

Cleveland, Aug. 24. — The contract for the additions to be made to the plant of the Valley Mould & Iron Co., Sharpsville, Pa., has been divided and 150 tons were placed recently with the McMyler Interstate Co., Bedford, O. Bids on the remainder, about 900 tons, are now being considered. No other structural contracts of consequence are pending and the fabricating shops so far have been unable to share in the general prosperity enveloping the steel business. Most of the large amount of new plant construction under way is of a character not requiring extensive tonnages of structural material.

(*For complete prices see page* 416.)

Shape Market Strong

Chicago, Aug. 24.—Fair activity is displayed in structural steel and while 1.49c, Chicago, continues to be the ruling quotation, some large mills are asking 1.54c. It is not believed, however, that much business has been done at the increased price and trade is not being eagerly sought by most mills, which are well filled. The Inland Steel Co. has announced 1.54c, Chicago, as its new price on shapes. The mills of the Illinois Steel Co. are receiving specifications in excess of capacity. Structural lettings last week aggregated 3,237 tons. The largest contract was awarded by Tehama county, Cal., involving 1,230 tons for three highway spans for reinforced concrete construction. The next largest letting was by the University of California, Berkeley, Cal. It involves 1,007 tons and was awarded to the Pacific Rolling Mill Co. The Atlantic Coast Line has closed with the Mt. Vernon Car Mfg. Co. for 750 cars. The American Car & Foundry Co. took 300 cars from the Nashville, Chattanooga & St. Louis railway.

CONTRACTS AWARDED.

Tehama county, Cal., three highway spans over Sand Slough, Sampson Slough and Paynes Creek, 1,230 tons.

City of San Francisco, Fourth street draw bridge across Channel street waterway, 400 tons, to Ralston Iron Works.

University of California, class room building, Berkeley, Cal., 1,007 tons to Pacific Rolling Mill Co.

Morris & Co., Chicago, cattle runways, U. S. Yards, Chicago, 218 tons to Jos. T. Ryerson & Son.

Vandalia R. R. Co., five 113-foot, 3-inch truss spans, Logansport, Ind., 560 tons to Wisconsin Bridge & Iron Co.

U. S. Ball Bearing Mfg. Co., building, Chicago, 130 tons, to Garden City Iron Works.

American Trona Corporation, building, Searlas, Cal., 400 tons to Dyer Brothers. Building for Epileptic colony, Woodward, Ia., 284 tons.

Addition to plant of Valley Mould & Iron Co., Sharpsville, Pa., 150 tons, to McMyler Interstate Co., Bedford, O. Bids on balance, 900 tons, now being considered.

Building for Bosch Magneto Co., Boston, 200 tons to the American Bridge Co.

Store building for Oppenheim-Collins & Co., Fulton street, Brooklyn; 1,000 tons, to the Hay Foundry & Iron Works.

Addition to the Gouverneur hospital, New York City; 400 tons, to the American Bridge Co.

Substructure for pier No. 35, East river, New York City; 200 tons, to the Belmont Iron Works.

Steel work for the Department of the Interior building, Washington; 6,300 tons, awarded the Riter-Conley Mfg. Co. by John H. Parker, New York City, the general con-

tractor. About 1,600 tons of Bethlehem sections included.

Franklin National Bank building, Philadelphia; 1,775 tons, to the Phoenix Bridge Co.

Extension to the plant of the New Departure Mfg. Co., Bristol, Conn., 200 tons to Levering & Gerrigues.

Bridges for the Baltimore & Ohio railroad, 230 tons, to an independent shop.

Bridges for the Western Maryland, 325 tons, to an independent shop.

Superstructure for pier No. 9 in Hudson river, New York City, for Central railroad of New Jersey, 900 tons now placed with Pennsylvania Steel Co., the low bidder.

Addition to the Massachusetts General Hospital, Boston, 300 tons, to the American Bridge Co.

Office building for the department of the interior, Washington, 6,000 tons, awarded the Riter-Conley Mfg. Co.

New buildings for the Baldwin Locomotive Works, Eddystone, Pa., 6,000 tons, awarded to the McClintic-Marshall Co., which had previously taken about 11,000 tons for the work at Eddystone.

CONTRACTS PENDING.

McMorrow apartment, Ninety-ninth street and West End avenue, New York; 700 tons, bids being taken.

Mayer & Mayer apartment, Sixty-third street and Park avenue, New York; 1,000 to 1,200 tons, bids being taken.

McLoughlin loft building, Thirty-sixth street, New York; 500 tons, bids being taken.

Dormitories and dining rooms for the Rensselaer Polytechnic Institute, Troy, N. Y.; several hundred tons, bids being taken.

Pier No. 13 for the Ward line, New York; 200 to 300 tons, bids being taken.

Bridge for the Philadelphia and Reading railroad, Milton, Pa.; 250 tons, bids being taken.

Buildings for the American Ice Co., Philadelphia; 300 tons, bids being taken.

Mordecai apartment, Fifty-fifth street and Park avenue, New York; 1,000 tons, bids being taken.

Herzog apartment, 114 East Eighty-second street, New York; 700 tons, bids being taken.

Marcaro apartment, 152 West Fifty-eighth street, New York; 600 to 800 tons, bids being taken.

Tishman apartment, 162-164 East Seventy-ninth street, New York; about 1,000 tons, plans being prepared.

Delaware school, Syracuse, N. Y.; 500 tons, being taken.

Hudson county jail, Jersey City, N. J.; 500 tons, bids being taken.

Robert W. Hunt & Co., Pittsburgh, will receive bids until Sept. 25 for 825 tons of steel for bridges for the Hankow-Iehand section of the Chinese Hankow-Szechuan government railroad, China.

Shop buildings and crane runway for the Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, 2,000 tons, bids being taken.

Bridge work for the Western Maryland railroad; 500 tons, bids being taken.

Office building at Forty-second street and Fifth avenue, New York, 1,800 tons, tentative plans prepared.

Valley Mould & Iron Co., Sharpsville, Pa., addition to plant, 900 tons.

G. F. Riddell, superintendent of the Chicago Heights Works of the Inland Steel Co., died at his home in Chicago Heights on Aug. 12. Death was due to heart failure. Mr. Riddell had been associated with the Inland Steel Co. since it was started in 1893.

Furnace Coke Weak

Inquiry and Sales Insufficient to Strengthen Market

Pittsburgh, Aug. 24.—The Connellsville furnace coke market continues in a state of lethargy. No demand of consequence is reported and prices remain weak and irregular. Advances made in the by-product coke oven practice the last few years appear to have seriously affected the market for Connellsville fuel, although some cokemakers are disinclined to admit that such is the case, attributing the present condition of the beehive oven trade to the depression that hit all branches of the iron and steel industry last year. Furnace fuel for quick delivery is being offered at $1.50, ovens, or 25 cents a ton below the market a year ago and $1 a ton below the prevailing quotation Aug. 21, 1913. Seventy-two-hour coke is comparatively strong. Specifications from foundries are increasing in volume and quotations show an advancing tendency. *The Connellsville Courier*, for the week ending Aug. 14, says production was 374,413 tons, an increase of 7,573 tons over the previous week.

Furnace Coke Weak

Philadelphia, Aug. 24.—Weakness of spot fuel and the inclination of producers to hold for an advance of at least 50 cents a ton on first-half contracts, represent the latest developments in the coke market to be noted in eastern territory. A sale of 50 cars of standard Connellsville coke for spot delivery was made to an eastern Pennsylvania steel-maker at $1.55, ovens. On eastern inquiries for first half, producers with one exception, have been unwilling to quote and the price named in this case was $2.50, ovens. A negotiation involving a large tonnage for an eastern furnace company for six to 12 months' delivery, is on the point of being closed, the price in which will be regulated by a sliding scale arrangement.

Coke Advanced

Cleveland, Aug. 24.—A leading merchant producer has advanced his quotations on 72-hour Connellsville foundry coke to $2.75 for delivery to July 1, 1916. Foundry inquiries are increasing in volume and further advances would not be surprising.

Coke Inquiry Out

Cincinnati, Aug. 24.—Furnace coke for the first half of next year is in good demand, but buyers are not willing to pay the prices asked. One southern Ohio furnace interest is trying to buy about 40,000 tons for the first quarter and another is contemplating the purchase of a like tonnage. Shipments of foundry coke on contracts are good, and indications are that the melt is increasing. Prices on Wise county, Pocahontas and New River grades are unchanged.

(*For complete prices see page* 416.)

Rails Are Quiet

Although Russia Buys Additional 5,000 Tons

New York, Aug. 24.—An additional lot of about 5,000 tons of rails has been placed by the Russian government with the Lackawanna Steel Co. This is to replace a similar tonnage lost Aug. 18 when the steamer Silver Wings was wrecked on Sable Island, N. S., while en route to Kala. As the delivery of these rails at tidewater completes the contract on the part of the mills, the loss falls upon the Russian government. The Lackawanna Steel Co. now has received about 100,000 tons of rails and track material for Russia, much of which already has been shipped. Other tonnages for that country are under negotiation with the American mills. It is provided in these specifications that either bessemer or open hearth quality may be shipped.

An eastern railroad system has placed 4,000 tons of rails additional for delivery this year to one of its western lines. The Lehigh & New England railroad has placed 1,500 tons with the Bethlehem Steel Co. Rail inquiries from domestic roads are light, but as recently pointed out, there probably would be much difficulty in delivering much additional tonnage owing to the fact that so many of the rail mills now are working upon the more lucrative orders for large rounds for shells.

Equipment orders still come slowly although builders consider the prospects better. The Atlantic Coast gave the 750 box cars it recently placed to the Mt. Vernon Car Mfg. Co. The Wells Fargo Express Co. has ordered 35 refrigerator cars from the Pullman Co. The New York Central lines still figure on cars by keeping a formal inquiry for 1,000 steel automobile cars before builders. The Chicago, Burlington & Quincy railroad has ordered a rotary snow plow of the American Locomotive Co.

The tube mill of the Susquehanna Iron Co., at Columbia, Pa., has resumed operations after an idleness of several years. The plant produces wrought iron pipe from ½ to 4-inch sizes.

Russian Trade

Will be Discussed at a Conference in Chicago

Chicago, Aug. 24.—For the purpose of establishing a large trade with Russia, representatives of a large proportion of 200 American manufacturers will attend a conference in Chicago on Aug. 30. The call was issued by A. S. Postnikoff, 1133-1135 Rookery building, who has suggested a strong organization to place business agents in every one of the numerous divisions of the Russian empire. It is proposed that each branch of the association, to be owned wholly by manufacturers belonging to it, will have a staff of Russian salesmen of good sales experience in the different lines of merchandise. Each salesman will handle only a few lines which can be presented to the same buyer, as, for instance, hardware, tools, electrical hardware, transmissions, machine tools, various steel products, etc., could be handled by other salesmen, who will call on plants in the branch's district, and so on, until 50 lines contemplated are taken up.

The commission of the sales company, said Mr. Postnikoff, being a net earning, will be available for dividends or reserve capital of the company. He stated that the question of credits which in the past has been a stumbling block to American manufacturers is being worked out by some Chicago banks.

Mr. Postnikoff, an American of Russian antecedents, for many years was a representative of the International Harvester Co. in Russia, and on his own account was interested in the exportation of Russian sugar beet seed. With him is associated X. B. Kalamatiano, who represented the J. I. Case Threshing Machine Co. in Russia previous to the war.

Messrs. Postnikoff and Kalamatiano, with the encouragement of the Chicago association of commerce, are pointing out to American manufacturers that in 1913, the year before the war, the total imports of Russia, amounting to $541,642,000, were furnished chiefly by Germany under exceedingly favorable terms which the Germans obtained by treaty after the Russo-Japanese war. That Germany will be able to renew an agreement so favorable to itself when the present war ends, Mr. Postnikoff considers out of the question. He does think, however, that be the state of feeling between Germany and Russia what it may, it will not deter German commercial enterprise from fighting earnestly to re-establish itself in Russia unless American manufacturers, by prompt action, accept Russia's friendly proffers and get there first.

Work Begun.—The contract for excavating for the new blast furnace to be erected at Canton, O., by the United Furnace Co. in co-operation with Pickands, Mather & Co. has been awarded to the J. F. Casey Co., Pittsburgh, and the excavating has been begun.

Will Refine Metals

The Detroit Metal Refining Co., Detroit, has taken over the Keeton works in that city and has converted it into a smelting plant for the refining of white metals and alloys. Sol Sadek, who was general manager of the Progressive Metal & Refining Co., Milwaukee, will direct the business of the new company, and while his future residence will be at Detroit, he will retain his interest in the Progressive company. The Keeton plant has been completely remodeled and modern equipment has been installed in its 2½ acres of buildings. The melting facilities include a battery of 48 furnaces. The officers of the company follow: I. Gerson, Toledo, president; L. R. Grosslight, Detroit, treasurer; S. Gerson, Toledo, secretary and Sol Sadek, general manager.

Many Orders Received

The Fulton Iron Works at St. Louis has received orders for sugar mills within the last 60 days that will keep the plant working 24 hours a day until next March, according to a statement made by W. D. O'Neil, purchasing agent for the plant. About one-third of the mills for which orders have been received will go to South America for the sugar plantations of Brazil, Peru and Equador, and the remainder will go to the West Indies. Mr. O'Neil says the plant has too much work ahead to pay any attention to war orders which are offered American manufacturers. The directors of the company will meet this week to consider the question of enlarging the plant.

Reduces Ocean Rates

Announcement is made that the American-Hawaiian Steamship Co. has reduced by $1 a ton the freight rate on finished steel products between the Atlantic and Pacific coast by way of the Panama canal. The new rate is 40 cents per 100 pounds, or $8 per net ton. Until recently, the steamship rate between the coasts has been 45 cents per 100 pounds, although one line has been offering some room at 40 cents. It is thought that the reduction in the steamship rates has been brought about by the new transcontinental rail tariff on iron and steel products going into effect.

(*For complete prices see page* 416.)

Metals Improve

Spelter in Better Demand—Resale Copper Offered

New York, Aug. 24.—The metal markets generally have manifested an improvement in underlying conditions during the week closing today. The feature of most interest is the turn which has developed in the spelter market. The pressure which had been exerted in this metal suddenly disappeared and accompanied by bids from large speculative interests, prices took an upward turn. As is to be expected in view of the present situation, a large demand has come into the market, especially for nearby shipment, and inasmuch as producers are showing no anxiety to quote, prices are ascending rapidly on a comparatively small volume of business. The market on prime western now is approximately 13c to 13.50c for prompt and nearby, and 11.50c to 12c for the last quarter shipment.

The lead market is showing a firmer tendency. The American Smelting & Refining Co.'s price continues 4.50c, New York, and 4.42½c, St. Louis. Second sellers are not showing so much disposition to shade. The outside market now is quoted at 4.40c to 4.45c, New York, and 4.30c to 4.35c, St. Louis. Producers report an improvement in the volume of inquiry, but very little business has been transacted as yet.

The aluminum market is interesting by reason of the scarcity of supplies. The domestic producer is sold as far ahead as ever and stocks in the hands of second sellers are very closely held. The outside market on carloads is 35c to 36.50c, for No. 1 ingots.

The tin market has been rather quiet although, due to the steadiness of prices, some business has been transacted every day. The interest of consumers is centered mainly in spot and nearby requirements. The market is quoted at 33.75c for spot and August; 33.25c for September and 34c for beyond.

Although copper producers report a better volume of inquiry there has been little actual business. Second hands continue to offer extremely low prices, and are quoting figures equivalent to 16c to 16.25c, delivered 30 days. Ordinary casting is quoted at 15.25c to 15.50c, cash, and good brands of lake are offered by second sellers at 16.12½c to 16.37½c, cash.

The antimony market continues to decline, due to the small demand. Spot Chinese and Japanese can be had at 28c to 29c, duty paid.

MEN OF THE IRON TRADE

Who they are **Where they are** **What they are doing**

Edward E. Walker, superintendent of the Erie Malleable Iron Co., Erie, Pa., has assumed also the position of vice president of the company.

Crawford B. Murtens has been appointed superintendent of the Chicago Heights Works of the Inland Steel Co., succeeding G. F. Riddell, recently deceased.

D. W. Bliem has been appointed chief engineer of Milliken Bros. Inc., Staten Island, N. Y. He formerly was connected with the Eastern Steel Co. at New York in a special capacity.

A. O. Baer, assistant superintendent of the blast furnace plant of the Illinois Steel Co. at the South works, South Chicago, has been appointed superintendent of blast furnaces for the Minnesota Steel Co., Duluth, Minn.

Charles H. Newcomb, Philadelphia representative of Crocker Bros., won the national amateur championship in trap-shooting at a contest held in Chicago recently. Mr. Newcomb is regarded as one of the best trap-shots in the United States.

Charles E. Duncan has been appointed superintendent of the rolling mills and axle plant of the Cambria Steel Co., Johnstown, Pa., to succeed J. C. Fox, resigned. Mr. Duncan has been identified with the Lake Superior Consolidated Steel Co., Sault Ste. Marie.

George H. Hull, formerly office manager of the Phoenix Tube Co., Brooklyn, N. Y., has become associated with Joseph T. Ryerson & Son's New York office and will travel in the western part of New York state. Ross H. Wilmot, formerly with Chisholm & Moore Mfg. Co., Cleveland, has also joined the Ryerson forces and will represent the firm in the New York metropolitan district.

E. P. Breckenridge has resigned from the presidency of the Toledo Machine & Tool Co. At the annual meeting of stockholders Mr. Breckenridge, who has been in active charge for 10 years asked that he be relieved of the duties of the office and moved that Henry J. Hinde be elected president. Mr. Hinde has been vice president and general manager for many years. L. J. Hinde was elected vice president and sales manager, and Charles W. Greening secretary and treasurer. The new board of directors includes H. J. Hinde, L. J. Hinde, E. P. Breckenridge, S. D. Carr, I. N. Bushong and E. C. Edwards.

Spencer Miller, of New York, and Wm. Leroy Emmett, of Schenectady, N. Y., have been nominated by the American Society of Mechanical Engineers, as members of the advisory board, of inventors, names for which Secretary of the Navy Daniels has asked the leading engineering organizations of the country to suggest. The Society of Automobile Engineers have named Howard E. Coffin, vice president of the Hudson Motor Car Co., Detroit, and Andrew L. Riker, an electrical and mechanical engineer. Mr. Miller is well-known in the engineering world for his improvement of the wire rope cableway. His carrier was used in the building of the Panama canal and he devised important equipment of this kind for the government in the Spanish-American war. Mr. Emmett is a graduate of Annapolis and after serving in the navy for several years, became associated with the General Electric Co. At the outbreak of the Spanish-American war, he returned to the navy. Notable in his work as an engineer has been the development of the Curtis steam turbine. Both Messrs. Coffin and Riker have reached high positions as motor experts.

Enlarging Works Capacity

A number of auxiliary improvements are being made by the Alan Wood Iron & Steel Co. to its Ivy Rock, Pa., works, which will considerably increase the capacity. In the open hearth plant, two 80-ton cranes are being installed, supplanting machines of smaller size. Larger ladles also are being added. These betterments are expected to increase the output of steel by about 20 per cent. Two additional heating furnaces are being built for the plate mill, which will increase the number of such units to five.

Purchases Syracuse Plant

A deal has just been closed between T. G. Meachem, vice president of the New Process Gear Corporation, and officers of the Union Typewriter Co. whereby the former corporation will acquire ownership of the Monarch Typewriter plant, Syracuse, N. Y., on Oct. 1.

The buildings of this Monarch plant cover two acres, and the surrounding land, which adjoins the property of the New Process Gear Corporation, includes an additional three acres. The main building is five stories high, is of brick and slow-burning mill construction, has a frontage of 480 feet on N. Franklin street, and extends back 350 feet to Onondaga creek.

The carrying capacity of the floors is to be increased by steel reinforcement from 200 to 300 and 350 pounds per square foot, the additional strength being necessary to provide for heavier material and machinery.

After alterations the Monarch plant will be used by the New Process Gear Corporation as the job gear and spur and transmission gear department and the present plant will be devoted exclusively to the manufacture of automobile differentials.

It is the intention of the New Process Gear Corporation to have more than 1,000 employes at work before spring, at which time the additional five-story building now being erected on property purchased recently will be completed and completely equipped.

Enlarges Plant.—The U. S. Reduction Co., East Chicago, Ind., has just enlarged its plant by the completion of two buildings, one to be used for receiving purposes while the other, a two-story structure, is a laboratory equipped with most modern devices.

C. P. Wetmore, former superintendent of the Dial Cash Register Co., Milwaukee, has organized the Wetmore Mechanical Laboratories Co. of Milwaukee, with $20,000 capital, to engage in general laboratory and research work of all kinds. M. J. Walsh, president, M. J. Walsh Machinery Co., and W. C. Sieker, well known in the Milwaukee metal-working field, are associated with Mr. Wetmore.

The Walter A. Zelnicker Supply Co., St. Louis, has purchased the good will and stock of the Bintliff Supply Co., successor to Bintliff & Herb, and is doing a general railroad, mill and factory supply business, specializing in railroad track tools.

Engineers' Meetings

Will Be Held at San Francisco—Oil Engines to be Discussed

New York, Aug. 24.—Members of the Civil, Electrical, Mining and Mechanical Engineers' Societies will leave here at 7:45 p. m., on Sept. 9, on a special train, due to arrive in San Francisco on the following Wednesday. In addition to visiting the Panama-Pacific International Exposition, members of the four societies will hold sessions for the presentation of papers on technical and engineering subjects. The American Society of Mechanical Engineers will hold two short sessions on the mornings of Sept. 16 and 17, which will be devoted to discussions of oil engines, especially as they are used in California. While this meeting will be arranged for by San Francisco members of the society, it will be of a general character and will be presided over by the officers of the society. The Mechanical Engineers' Society will hold its sessions in the hall of the Native Sons of the Golden West. The American Institute of Mining Engineers will hold sessions on Sept. 16, 17 and 18, in the Hotel Bellevue, San Francisco. A number of papers on iron and steel subjects will be presented.

Crucible Steel Advanced

Because of the scarcity of ferrotungsten, the Vanadium Alloys Steel Co., Pittsburgh, again has advanced quotations for all grades of high speed tool steel. The company is refusing to quote, except for immediate delivery. Quotations offered by the Vanadium-Alloys company are as follows: red cut cobalt, bar stock, round, flat and square, $1.25 per pound, base; red cut superior, bar stock, round, flat and square, $1.15 per pound, base, subject to extras adopted July 22, 1915; red cut cobalt, treated bits, $1,75 per pound; red cut superior, treated bits, $1.50 per pound; high speed discs, 25 per cent over list prices. Bar stock has advanced 10 cents a pound this month. Prevailing quotations for this material are from 60 to 70 cents a pound above the market four months ago. Treated bits have advanced 25 cents a pound this month and are commanding from $1 to $1.25 above the market last spring.

Increases Force.—Rush orders for steel bridges in Missouri, Illinois and throughout the southwest have caused the East St. Louis Bridge Co. in Washington Park, East St. Louis, Ill., which ordinarily works 100 men on a day shift, to increase its force 75 men and run night and day. The orders are for steel bridges to replace wooden structures washed out by the heavy rains of the last two months. Most of the orders are from Missouri.

Steel Mill Engineers to Meet

Many interesting papers will be read and discussed at the ninth annual convention of the Association of Iron and Steel Electrical Engineers, at the Hotel Statler, Detroit, Sept. 8 to 11. Among the papers to be presented are the following:

"Wire Rope in Its Relation to Steel Making", by James F. Howe; "Progress in the Iron and Steel Industry and the Electric Furnace", by Dr. Karl George Frank; "Electrification of Steel Mills and the Use of Central Station Power", by Bert Wiley and Wilfred Sykes; "Purchased Power for Steel Mills", by C. S. Lankton; "Some Electrical Applications in Steel Mill Practice", by D. M. Petty; "Latest Development of Electric Cranes for Steel Mills, Manufactured by the Alliance Machine Co.", by E. H. Kendall; "Installation of Electrical Equipment to Comply With Requirements of Safety", by Walter Greenwood. The association's annual banquet will be held Thursday evening, Sept. 9. The final afternoon session, Saturday, Sept. 11, will be devoted to excursions and visits to various points of interest in and around Detroit.

Dredging May Delay Construction

The Ford Motor Co., Detroit, is negotiating with builders of iron and steel works equipment for the new plant which it expects to erect in Detroit. These negotiations, however, have not reached a definite stage and it is believed that the Ford company will not go ahead with the blast furnace and steel plant end of its project until the ore-handling question is out of the way. In order to deliver ore cargoes to the site of the proposed plant, it will be necessary to dredge a channel which will cost from $3,000,000 to $5,000,000. It is expected that federal aid will be obtained in the construction of this waterway, but the necessary negotiations with the government may occupy a considerable period. In the meantime, however, the Ford company is proceeding with the plans for its improvements, which include blast furnaces, rolling mills and by-product coke ovens, as previously announced in *The Iron Trade Review.*

Building Large Ore Dock

Work is going ahead rapidly on the construction of the large iron ore dock which the Lehigh Valley railroad has planned for Constable Hook, Bayonne, N. J., to receive shipments of foreign minerals for eastern blast furnaces. This dock especially will serve the ore traffic of the Bethlehem Steel Co. from its Chilean mines. The Bethlehem company is arranging to bring in eventually 1,500,000 to 2,000,000 tons annually from these mines. The dock also will be used for transatlantic ore and probably to receive the heavier shipments of Port Henry ore by barge which are promised upon the completion of the enlarged New York state canal system. The ore pier is 67 feet wide and 1,060 feet long and has room for four railroad tracks. The basin will be 200 feet wide and the depth of channel will be 35 feet at low tide. The pier will be equipped with two unloading machines with a maximum capacity of 500 tons per hour. It is expected that the plant will be ready for operations about Jan. 1.

Enlarging Shipyard Capacity

New York capitalists who through Chas. P. M. Jack, a consulting engineer of New York, acquired control of the shipbuilding end of the old Roach shipyard, Chester, Pa., to engage in general vessel construction, now have incorporated the Chester Shipbuilding Co. with a capitalization of $1,500,000. The incorporators are G. F. Jebbett and F. H. Butehorn, of New York City, and T. S. Buckingham, of Brooklyn. Work now is under way toward the rehabilitation of this yard and it is expected that the company will be in shape to begin shipbuilding within a few months. The Baltimore Dry Dock & Shipbuilding Co., Baltimore, also has awarded important extensions to its plant.

The Duff Mfg. Co., Pittsburgh, manufacturer of lifting jacks, is building a 125 x 150-foot extension to its main factory building. When this extension is completed this structure will be 625 feet long and 125 feet wide. A 5-ton bridge transfer crane and a monorail conveying system, together with considerable additional equipment, are being installed.

The Franklin plant of the American Steel Foundries, of Franklin, Pa., will resume operations Sept. 1, after a shutdown of 11 months.

Ore Mined

In United States Shows Sharp Decline for 1914

The quantity of crude iron ore mined in the United States in 1914 amounted to 41,439,761 long tons, as compared with 61,980,437 long tons mined in 1913, a decrease of 20,540,676 long tons, or 33.14 per cent, as reported by E. F. Burchard, of the U. S. Geological Survey. The quantity of iron ore shipped from the mines (marketed) in the United States in 1914 amounted to 39,714,280 long tons, valued at $71,905,079, as compared with 59,643,098 long tons, valued at $130,905,558, marketed in 1913. This represents a decrease in quantity of 19,928,818 long tons, or 33.41 per cent, and in value of $59,000,479, or 45.07 per cent. The average price of ore per ton for the whole country in 1914 was $1.81, as compared with $2.19 in 1913. These quantities of ore, both mined and marketed, include the iron ore used for fluxing other metallic ores at smelters in the middle and western states, but the marketed ore does not include the iron ore sold for the manufacture of paint. The quantity of iron ore marketed for paint manufacture in 1914 amounted to 18,452 long tons, valued at $46,995. The ore reported as sold for fluxing purposes other than in the manufacture of pig iron amounted to 42,677 long tons, valued at $114,985, in 1914, as compared with 62,842 long tons, valued at $235,588, in 1913. The domestic iron ore actually marketed for the manufacture of pig iron amounted in 1914 to 39,671,603 long tons, valued at $71,790,094, as compared with 59,580,256 long tons, valued at $130,669,970, in 1913.

Iron ore was mined in 27 states in 1914, as compared with 28 states in 1913, no commercial production having been reported from Texas in 1914. of these states, four—Idaho, Montana, Nevada and Utah—produced ores for flux only; part of Colorado's production was for fluxing and part for pig iron; the remaining states produced iron ore for blast furnace use only, except small tonnages for paint from Georgia, Michigan, New York, Pennsylvania and Wisconsin.

The five states producing the largest quantity of iron ore are Minnesota, Michigan, Alabama, Wisconsin and New York, the first three of which produced more than 1,000,000 tons each.

Iron Ore Mined in the United States in 1913 and 1914.

State.	Quantity (long tons). 1913.	1914.
Minnesota	38,658,793	21,946,901
Michigan	12,841,093	10,796,200
Alabama	5,215,740	4,838,959
Wisconsin	1,018,272	886,512
New York	1,459,628	785,377
Pennsylvania	489,056	406,326
Virginia	483,843	378,520
Wyoming	537,111	366,962
New Jersey	325,305	350,135
Tennessee	370,002	330,214
New Mexico	164,085	81,980
Georgia	155,236	67,722
North Carolina	69,235	57,667
Missouri	39,354	37,554
Kentucky	3,400	21,400
Utah	14,690	*
Colorado	*	10,464
Connecticut	*	9,149
Massachusetts	*	7,600
West Virginia	7,808	6,530
Maryland	*	6,369
Ohio	7,849	5,138
Montana	2,475	*
California	2,092	1,282
†Other States	115,370	40,800
Total	61,980,437	41,439,761

*Included in Other States.
†In 1913: Colorado, Connecticut, Idaho, Maryland, Massachusetts, Mississippi, Nevada and Texas. In 1914: Idaho, Mississippi, Montana, Nevada and Utah.

The Minnesota ranges are still producing more iron ore than is produced in the rest of the states together, having furnished 52.96 per cent of the total for the United States in 1914, as compared with 62.37 per cent in 1913. The Lake Superior district, comprising all the mines in Minnesota and Michigan and those in northern Wisconsin, mined 33,540,403 long tons in 1914, or 80.94 per cent of the total production.

Ore shipments from the Lake Superior mines as shown by statistics compiled by *The Iron Trade Review* were 32,729,726 tons in 1914 and 49,947,116 tons in 1913.

Kentucky Lead and Zinc Fields Active

Increased prices for lead and zinc have resulted in a great stimulation of activity in the Crittenden county, Ky., fields, which are rich in those ores and fluorspar. A great many abandoned shafts are being worked again. The greatest handicap the section has had has been the lack of railroad facilities, and much of the ore is being hauled by wagon to the mills at Marion, Ky. The mills of the Kentucky Fluorspar Co., the R. L. Moore Co. and the Saunders Ore Separating Co. are being run overtime at present, night operation having been the rule recently. It is expected that further development of the rich metal ore deposits of that district will follow the present boom.

Morton Decker, president of the Standard Separator Co., Milwaukee, and a well-known inventor of dairy machinery, recently was found dead in the bathroom of his apartment. The gas jet was turned on without being lighted. Mr. Decker was 50 years old and a native of Sussex county, N. J.

The Trussed Concrete Steel Co., Youngstown, will furnish the reinforced steel for a court house, to be erected at Walla Walla, Wis.

Rails Placed

Steel Corporation Receives Orders for 30,000 Tons

New York, Aug. 25. (By wire.)—Domestic lines have placed about 30,000 tons of rails with the United States Steel Corporation in odd lots, including 15,000 tons to the Tennessee Coal, Iron & Railroad Co. On some of these no delivery promise was made because of filled condition of mills.

The American Bridge Co. has been awarded 6,000 tons of subway steel for the Manhattan section by the Holbrook, Cabot & Rollins Corporation.

Shrapnel Bars

Aggregating 30,000 Tons Bought by France and Russia

New York, Aug. 25. (By wire.)—France has placed an order for 15,000 tons of 3¼-inch rounds for early shipment with an eastern mill. Russia has made final arrangements to take 15,000 tons of 3⅞-inch rounds from the same maker.

Withdraws From Market

Chicago, Aug. 25. (By wire.)—The Inland Steel Co., which re-entered the galvanized sheet market this week withdrew today because of the advance in price of spelter.

The Colonial Supply Co., Pittsburgh, has issued an 88-page catalog, containing illustrations and descriptions of several hundred devices which will be found of value in protecting workmen from injury. The catalog is styled, "Safety First Manual".

The Republic Iron & Steel Co. has awarded contracts for stacks for two additional open-hearth furnaces, to be erected at Lansingville, O., to the Reeves Boiler Co., Alliance, O.

The Standard Steel Car Co., Pittsburgh, has received an order for 75,000 shells for the allies, according to reports from New Castle, where shells will be made.

The Philadelphia office of Charles Dreifus Co., iron and steel scrap merchants, has been removed from 518 and 519 Pennsylvania building to Nos. 1316 and 1317, the same building.

Effect of Titanium Alloys on Steel

A Consideration of the Various Forms of Titanium Mixtures and Their Use as Deoxidizing Agents in Steel Manufacture

BY GEORGE F. COMSTOCK

TITANIUM is one of the chemical elements which is widely distributed in the earth's crust in small quantities but is not especially abundant. It has a very strong affinity for oxygen, and is always found in nature as an oxide, its principal ores being rutile, the fairly pure dioxide, and ilmenite, a mixture of iron and titanium oxides. One of the element's chief peculiarities is the readiness with which it combines with nitrogen. It is one of the very few elements which will "burn" in an atmosphere of nitrogen. Its dioxide is one of the most stable compounds known, and the expenditure of great energy is required to decompose it. Thus it follows that when titanium is separate from its oxygen, it will readily recombine with it and energy will be evolved again in the form of heat. The value of titanium in the steel industry is due largely to the fact that its dioxide is so much more stable than iron oxide that its action in robbing melted steel of its oxygen, or "deoxidizing" it, is very powerful.

In order to obtain titanium in a form useful for this purpose, it is necessary to reduce the oxides found in nature to some metallic state. There are two known ways of doing this, by reduction with carbon under the intense heat of the electric arc, and by an alumino-thermic reaction, whereby aluminum is oxidized at a high temperature at the expense of the titanium. The former process delivers the titanium in the form of a carbide, while the latter produces an alloy of titanium, aluminum and iron. The carbide of titanium is the form most generally used, for reasons that will be explained below.

Before proceeding to consider the effects of titanium on steel, it may be well to explain more clearly the relation of the element to the compounds mentioned above. Arranged in the order of increasing stability we have the series:

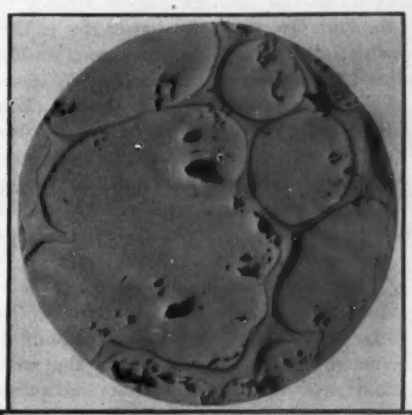
Titanium
Titanium carbide
Titanium nitride
Titanium oxide

Each member of this series tends under favorable conditions to be converted into one of the following members. Thus metallic titanium when heated to redness in pure nitrogen forms titanium nitride, but when heated in air only the oxide is formed. The nitride when heated to redness in air is slowly converted to the oxide, but the carbide burns vigorously in air, forming titanium dioxide. The reverse reaction, driving the oxide back to carbide, takes place only at very high temperatures and with the expenditure of great energy. Even at the temperature of the blast furnace titaniferous ores do not give more than 1 per cent of titanium in the pig iron. This is probably present partly as carbide and partly as cyano-nitride, a mixture of carbide and nitride. Although in the blast furnace titanium nitride is sometimes formed, it is not present in the titanium-carbide alloy used in treating steel, for at the temperature of the electric arc furnace, in which this alloy is made, with a reducing atmosphere and excess carbon, the nitride is dissociated in favor of the carbide.

Beside titanium there are other elements that are used more or less frequently to deoxidize steel. Among these are aluminum, manganese, and silicon. The comparative efficiency of these elements as "corrective agents" for defects in steel ingots has been tabulated by Prof. Bradley Stoughton. It is shown that for all-around effectiveness titanium is a good deoxidizer. For these purposes the carbide is believed

A paper presented at a recent meeting of the New York section of the Society of Chemical Industry. The author is connected with the Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

Fig. 1



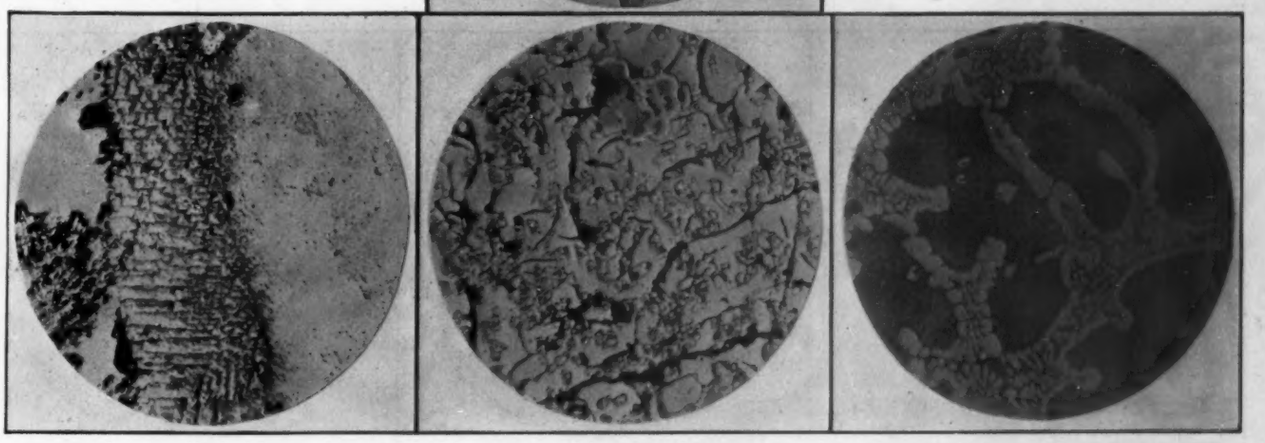


Fig. 2 Fig. 3 Fig. 4

SECTIONAL VIEWS OF TITANIUM ALLOYS HIGHLY MAGNIFIED, SHOWING DISTINCTIVE STRUCTURE OF EACH

Fig. 1 shows titanium carbide, made in laboratory, magnified 100 diameters and unetched. The large grains are light violet in color, and the substance between them, which was more yellowish, is probably iron carbide. The black spots are pits in the surface. Fig. 2 shows titanium carbide (above) dissolving into steel (below), showing particles of carbide also scattered through steel. Magnified 200 diameters and unetched. Fig. 3 illustrates ferro-carbon-titanium, magnified 100 diameters and unetched. The rounded grains standing out in relief are titanium carbide and the black streaks are graphite. Fig. 4 shows an alloy of about 12 per cent titanium, 6 per cent alluminum and 0.5 per cent carbon in iron, magnified 100 diameters and etched with nitric acid.

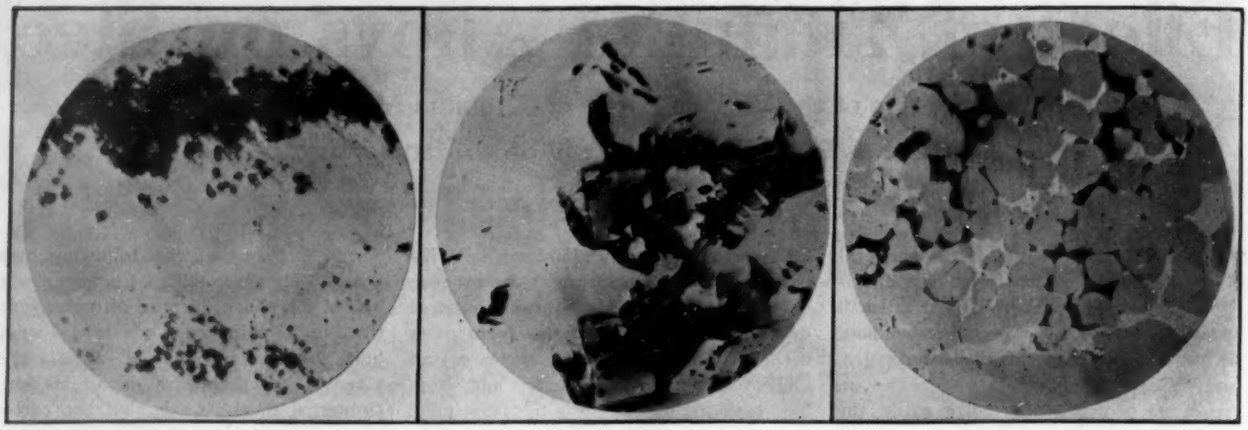


Fig. 5 Fig. 6 Fig. 7

HIGHLY MAGNIFIED SECTIONS OF TITANIUM ALLOYS AND COMPOUNDS

Fig. 5 shows a streak of alumina found in Swedish iron after remelting with alumino-thermic ferro-titanium. Magnified 400 diameters and unetched. Fig. 6 reveals a crystal of pink titanium nitride in alumino-thermic ferro-titanium, magnified 200 diameters and unetched. The black spots are pits in the polished surface. Fig. 7 illustrates titanium nitride, magnified 100 diameters and unetched. The rounded grains are bright yellow in color; the lighter substance between them is probably carbide, and the darker substance, oxide.

to be at least as valuable as the pure metal in regard to the results obtained. In regard to expense there is a very great difference in favor of the carbide, as this can be obtained in carload lots for about 8 cents a pound with a titanium content of 15 to 20 per cent, while the cost of metallic titanium would be prohibitive. The material sold at this price is made at Niagara Falls by the Titanium Alloy Mfg. Co. It consists of microscopic particles of titanium carbide held in a matrix similar to gray cast iron. When added to melted steel the matrix dissolves quickly, and the particles of titanium carbide are rapidly diffused through the bath, where they react with great vigor on the oxygen present.

The alumino-thermic alloy, which contains very little carbon, is of course, an alloy of both aluminum and titanium in iron, and hence its use involves the production of the effects of both these elements. Aluminum oxide, which is formed when steel is deoxidized by this element, is exceedingly infusible, and its tendency toward making all metallurgical slags infusible and viscous is notorious. Hence these particles of alumina (more or less pure) solidify in steel as soon as they are formed, and have no tendency to rise into the slag at the top of the ladle or mold. Moreover, by mixing with other small slag inclusions in the steel, the alumina makes them more viscous, and helps to keep them back in the metal. In the same way when silicon alone is used to deoxidize steel, the metal is filled with small inclusions of iron and manganese silicates, which do not remove themselves before solidification.

Titanium oxide, however, acts as a flux for silicates and other slags that may be in the steel, making them fluid enough to rise to the top of the metal and pass into the slag under conditions that might otherwise have held them back in the metal. Various researches have tended to demonstrate this action of titanic oxide in rendering slags more fluid, when added in not too large amounts. Thus it is seen that a good cleansing action is obtained when the titanium is added without aluminum, or in the form of the carbide rather than as the alumino-thermic alloy. The latter should be used, however, in the cases where the addition of the carbon of the ferro-carbon-titanium alloy could not be tolerated in the steel. In soft steels, the increase in carbon content from this addition as usually practiced would not be more than about 0.01 per cent, so that the cases where this would make any material difference are very few indeed. A great deal of the titanium used in steel in this country at the present time is in the form of ferro-carbon-titanium, and a large percentage of this is used for rail steel although its use in other

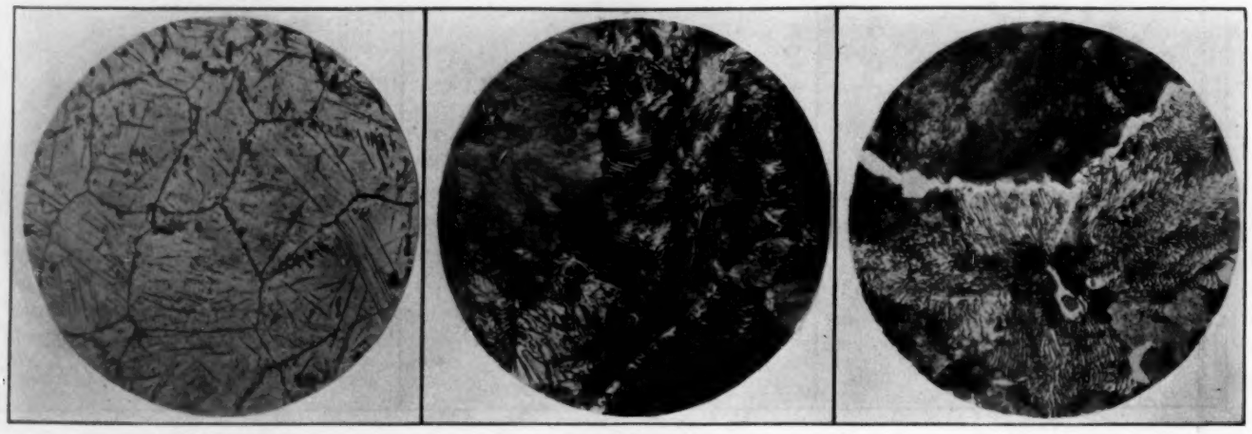


Fig. 8 Fig. 9 Fig. 10

EFFECT OF TITANIUM ALLOYS ON RAIL METAL AS SHOWN BY ETCHED CROSS-SECTIONS

Fig. 8 shows a high-carbon spot in cross-section of web of untreated rail which showed excessive segregation, magnified 100 diameters and etched with alkaline sodium-picrate. The black streaks are cementite, and the light grains are pearlite. Fig. 9 shows the center of head of a titanium-treated open-hearth rail, magnified 400 diameters and etched with picric acid, showing normal pearlite. Fig. 10 illustrates the center of head of a titanium-treated bessemer rail, magnified 400 diameters and pearlite, ferrite, and small sulphide inclusions, etched with picric acid.

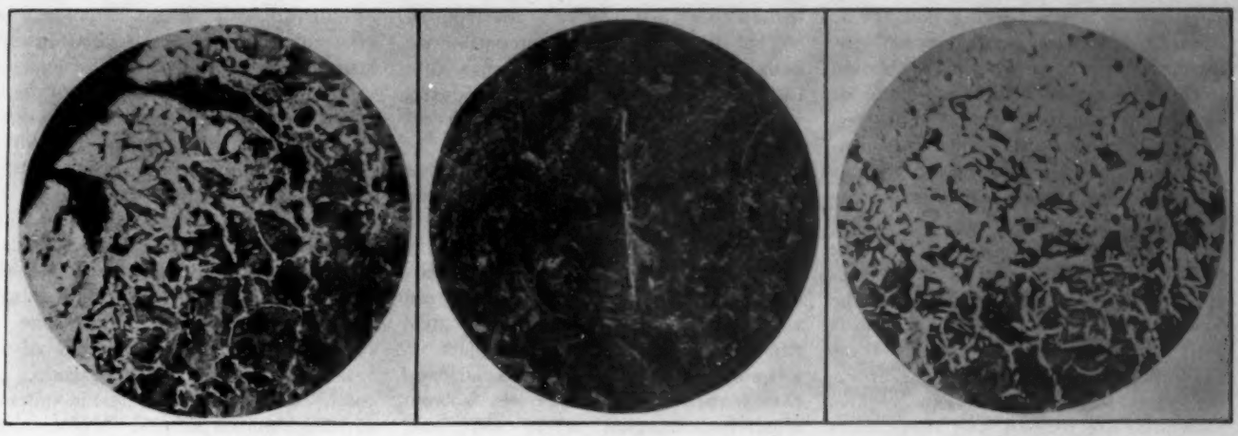


FIG. 11—TOP OF HEAD FIG.12—WEB FIG. 13—BOTTOM OF FLANGE

Views of cross section of typical untreated "A" rail, showing seams at top of head, cementite in web, and soft weak base. All magnified 100 diameters and etched with picric acid.

steels is making considerable headway. "Titanium steel", properly speaking, is not made commercially at present. Such a title naturally implies a steel whose properties are dependent to an appreciable extent on a certain content of titanium. But the advantages of the titanium-treated steels as made today are due to greater soundness, cleanness, and less segregation, and not, as far as we know at present, to the small amount of titanium left in the solid metal. In no case has over 0.025 per cent of titanium been found in any sample of titanium-treated steel known to the writer. Of course it is possible that this very small titanium content is in some way associated with impurities so as to distribute them uniformly, thus preventing segregation, but we do not know that there is any such association and hence are not justified in considering titanium-treated steel as a true alloy steel. It is very difficult to make steel absorb more titanium than the 0.025 per cent noted above under the usual conditions of manufacture, and no use has yet been found for steel containing larger quantities, that would warrant the attempt to produce commercially a real "titanium steel."

Steels made by the bessemer, open-hearth, or crucible processes may be, and are, treated with titanium, but most of this element is used in open-hearth steel on account of the greater tonnage of this steel manufactured. The alloy is furnished in various sizes, from lumps of about 1 inch diameter to powder, according to the quantity of steel to be treated at one time, and for the best results it must be added to the melted steel as it flows from the furnace to the ladle. The addition must of course be entirely completed before the slag has begun to flow out on top of the metal. After the addition, the steel must be held in the ladle for from three to 10 minutes, depending on the size of alloy used and the mass of steel treated, to allow the titanium to become thoroughly diffused, the deoxidizing reactions to take place, and the titanium and other oxides to rise out of the metal into the slag. Then the steel is teemed as usual into the molds where no further additions should be made. The amount of alloy recommended for use in rail steel is 13 pounds per ton, which means, since the ferro-carbon-titanium is said to carry over 15 per cent titanium, an addition of 0.1 per cent of metallic titanium. A higher grade alloy is not used because its rate of solution in the melted steel would be slower. The price of rails treated in this way is about 5 per cent above the price of ordinary rails. For castings and soft steels a smaller amount of alloy may be added, but in every case it is important to allow time for the reaction to take place completely in the ladle, before the steel gets into the molds. The heat of the reaction will usually prevent the formation of a skull in the ladle, and it is not necessary to tap the steel hotter from the furnace to allow for cooling while the ladle is being held.

Smaller amounts of titanium have been tried in rail steel, with the usual precautions of holding in the ladle, etc., but the best results have not been obtained. This indicates not only that it is not safe to skimp the amount added, but also that merely holding the steel in the ladle will not give the cleanness and homogeneity that result from the titanium treatment.

The two great advantages of well-deoxidized steel are (1) soundness, or freedom from blowholes, and (2) ab-

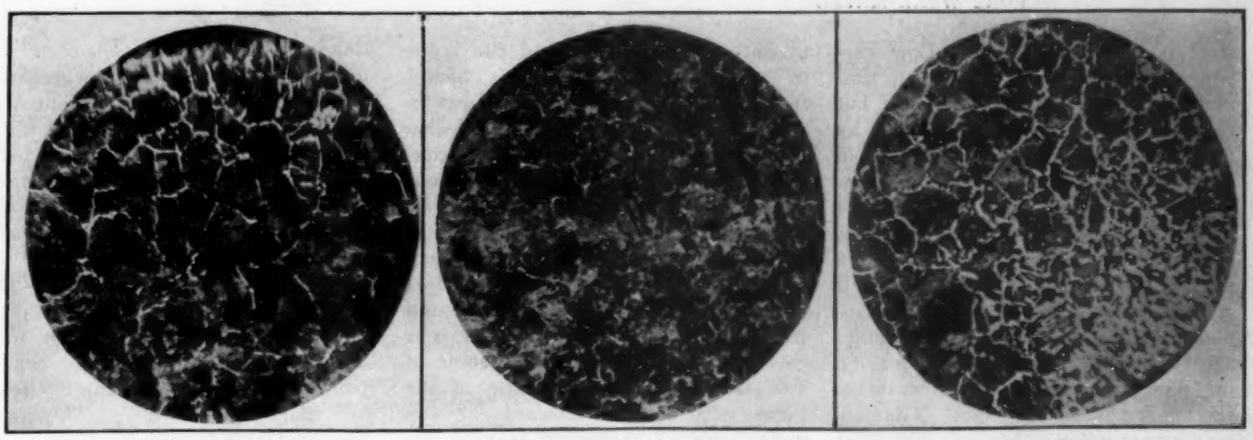


FIG. 14—TOP OF HEAD FIG. 15—WEB FIG. 16—BOTTOM OF FLANGE

Views of cross-section of typical titanium-treated "A" rail, showing good distribution of pearlite and ferrite in all parts of section. All magnified 100 diameters and etched with picric acid.

sence of excessive segregation. The manufacture of both bessemer and open-hearth steel is essentially an oxidation process, the carbon being burned out of pig iron in each case, and the steel necessarily contains a considerable quantity of oxide when first made. If this is not removed before solidification begins, the iron oxide in the steel continues reacting with the carbon, forming carbon monoxide, a gas which passes up continually in small bubbles to the surface of the metal, where it burns with a bluish flame. If some of these gas-bubbles are trapped in the freezing metal before they can escape, blowholes are formed, and these holes may be welded together when the steel is rolled or forged. Low carbon steels even if treated with titanium, usually contain blowholes, but the steel being normally cleansed by the titanic oxide, they are free from slag and are closed up when the ingots are worked. If they become oxidized however, or contain slag, they will open up as seams or remain as slag inclusions in the metal. It is well known that if steel is completely deoxidized, and no blowholes are formed, a large shrinkage cavity, or "pipe," will form in the center of the upper part of the ingot. Titanium may cause piping, as well as other deoxidizers, but by properly designing the molds piping may be controlled so as not to give much trouble.

The dependence of segregation on deoxidation is less obvious than that of soundness. Primarily, of course, segregation is due to selective freezing. The freezing-point diagram of the iron-carbon alloys shows that with ordinary steel the first metal to freeze is of lower carbon content than the remaining liquid, and the last liquid to freeze is of higher carbon content than the already frozen solid. But with well-deoxidized steel this selective freezing takes place in a quiet mass of pasty material, and the higher-carbon liquid is so intricately entangled in the lower-carbon solid that it does not have chance to gather in the center of the ingot to any great extent, and is finally frozen together with the lower-carbon material. The characteristic is somewhat like that of a sponge holding water. But assume that this steel is not well deoxidized, but is giving off gas. This gas, being of course much lighter than the metal, has a strong tendency to rise; in rising while the metal is in pasty condition, part liquid and part solid, it opens up passages through the steel, and each bubble of gas will take with it a little of the higher-carbon liquid toward the top and center of the ingot leaving the solid lower-carbon material behind. This action, multiplied many times by the millions of gas bubbles given off, will result in the formation of a large body of higher-carbon material in the upper part of the ingot, or in other words, there will be excessive segregation. Phosphorus is subject to this action in the same way as carbon, and sulphur, existing in the steel as small non-metallic globules composed of a mixture of iron and manganese sulphides with a freezing point not much, if any, higher than that of the metal, is even more affected. For this explanation of the relation between segregation and oxides in steel, the writer is indebted to the kindness of N. Petinot, metallurgist of the Titanium Alloy Mfg. Co.

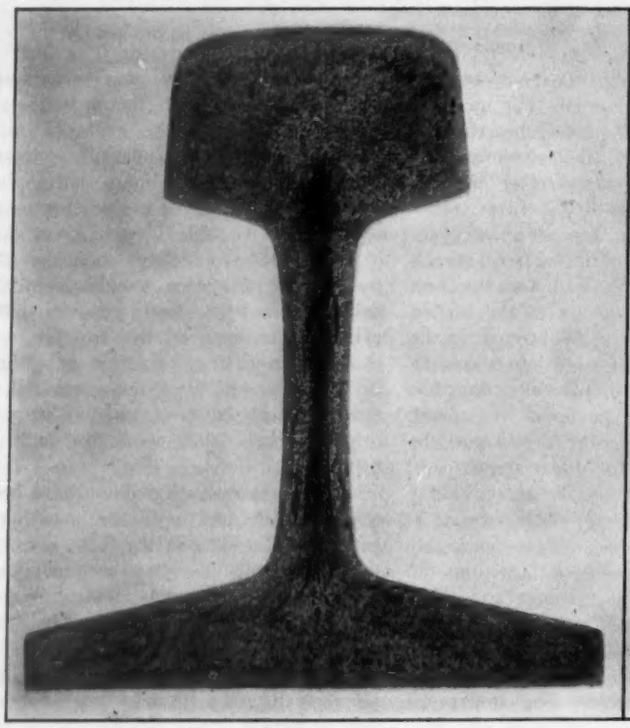


FIG. 17 — SULPHUR PRINTS OF CROSS-SECTIONS OF TYPICAL UNTREATED "A" RAILS. THE BLACK SPOTS AND STREAKS INDICATE GROUPS OF SEGREGATED SULPHIDE INCLUSIONS, AND THEREFORE WEAK METAL

FIG. 18 — SULPHUR PRINTS OF CROSS-SECTIONS OF TYPICAL TITANIUM TREATED "A" RAILS. AN EVEN DISTRIBUTION OF THE SULPHIDE INCLUSIONS IS A CHARACTERISTIC OF TITANIUM-TREATED RAILS

Aluminum and also vanadium and silicon have an effect on segregation similar to that of titanium, but with the cheaper agents, silicon and aluminum, not only would the cleansing action of the titanium dioxide be lacking, but impurities would be added to the steel, in one case silicates, and in the other alumina. In this connection it should be noted that in most rail steel that has been properly treated with titanium, very small hard angular pink inclusions can be found with the microscope. These are titanium nitride, possibly contaminated with carbide, and show that the titanium has combined with some of the nitrogen dissolved in the steel,

and separated it in this form. An average of many nitrogen determinations made by an improved method on titanium-treated rails shows a distinctly lower amount present in solution in the metal, than in untreated rails. No method is known for determining nitrogen that is combined with titanium in this form. Thus the difference in nitrogen content of the metal may be due merely to the locking up of some nitrogen by titanium in the pink inclusions, or also partly to the actual removal of nitrogen from the liquid steel bath. At any rate, if it is assumed that nitrogen has an injurious effect on steel, the lower amount found by analysis must be an advantage, for even if the whole amount removed from the metal itself is still present in the pink inclusions, it could have no more ill effects in this form than any other non-metallic inclusions of the same size. As the titanium nitride inclusions are never found segregated in groups or streaks, but are always very small, scarce, and thinly scattered, their weakening effect on the metal is practically negligible. They have been found in titanium-treated steel axles as well as rail, but not in steel castings or soft steels, where smaller amounts of titanium have been used.

It is an unfortunate fact that some so called titanium-treated steels have not been any better in regard to segregation than the average untreated steel. In every case these segregated "treated" rails have not shown a titanium content of over 0.005 per cent (while the average of treated rails are well above that figure) and the pink nitride inclusions have also been absent from them. These facts indicate that not enough titanium was actually added in these heats to produce the usual effects. Either the heats were badly oxidized, and needed more than the usual amount of titanium, or some of the alloy was lost or wasted in the slag. It is well known that chemical reactions do not in most cases proceed rapidly to completion when only the theoretical amount of reagent is applied, but an excess is usually needed. In the case of deoxidation of steel with titanium, the excess necessary is probably at least 0.005 per cent.

Having now explained the reasons for the addition of titanium to steel, and its general effects thereon, it may be of interest to give some concrete examples of the improvement, shown by testing machines and service, of titanium-treated steel as compared with plain untreated steel of the same general composition. It must be emphasized again that as the amounts of titanium found in treated steels are entirely negligible, so no change in micro-structure of the steel is caused by it, and the physical properties are no better than are theoretically possible with perfectly clean and sound steel of the given composition. Our most complete knowledge on this subject has been acquired with rail steel, and 42 samples of plain and treated open-hearth steel rails have been exhaustively tested, physically and chemically. For this purpose the samples have all been taken from the "A" rails, or first rails rolled from the ingots, after the usual discards from their tops, thus representing in each case metal from the top part of an ingot, which would show the greatest amount of segregation and impurities. The "A" rails from which samples were to be taken were chosen at random from the products of various mills and at different times by the manufacturer's or the purchasing railroad's representatives, but the samples were always taken in pairs, one treated and one untreated from each rolling, so that in the final comparison the influence of the conditions of manufacture could be as far as possible eliminated. All samples submitted were tested by the same methods. The final averages of all the results are tabulated below. The chemical composition of the rails is as follows:

	Untreated rails. Per cent.	Treated rails. Per cent.
Carbon low.....	0.58	0.63
Carbon high.....	0.82	0.76
Manganese low..	0.71	0.75
Manganese high..	0.78	0.79
Phosphorus low.	0.016	0.018
Phosphorus high.	0.026	0.023
Sulphur low.....	0.032	0.031
Sulphur high....	0.058	0.040
Silicon low.....	0.117	0.090
Silicon high.....	0.131	0.099

The tensile tests gave results as shown in the accompanying table.

Brinell hardness tests resulted as follows:

	Untreated rails.	Treated rails.
Head	220	226
Web	248	235
Flanges	216	227

Impact resistances were measured with a Fremont machine, and are expressed as kilogram-meters expended in breaking a test-piece 7 x 10 millimeters in cross-section. The results were as follows:

	Untreated rails.	Treated rails.
Head	1.47	1.58
Web	1.08	1.21
Flange	1.23	1.43

Endurances were measured with a Landgraf-Turner machine. This machine bends a thin test-bar backward and forward through a small angle by quickly alternating blows, and the results are expressed as alternations endured before fracture. The stresses applied to the test-piece are above its elastic limit. The figures are as follows:

	Untreated rails.	Treated rails.
Head	1,312	1,280
Web	1,001	1,084
Flange	1,324	1,270

Endurances also were measured with a White-Souther machine. This machine holds a test-bar in the middle, turning it very fast like an axle, while weights are suspended from its ends. The stresses applied are below the elastic limit, and the failure is thus due to fatigue. The results are expressed as revolutions endured., but many test-bars were removed unbroken after thirty or forty million revolutions. Untreated rails failed at 16,550,920 revolutions and treated rails at 23,923,628 revolutions.

As the above figures represent tests on 21 untreated rails, and an equal number of treated rails, with all other conditions kept as nearly alike as possible, it is believed that they possess real value as showing the improvement to be expected in "A" rails when properly treated with titanium. The improvement in other rails, from lower positions in the ingots, would be much less marked, but the rails that give most of the trouble in service are the segregated "A" rails, and these are rendered practically as uniform and homogeneous as the other rails by treatment with titanium. Titanium-treated rails are not better, probably than the best possible untreated rail; but by this treatment the general standard of quality is raised, uniformity is more nearly attained, and the bad heats of dangerously segregated or dirty steel are avoided.

In order to acquire still more positive data on the effect of titanium on segragation in rails, 79 "A" rails from different untreated heats and 31 sim-

(*Continued on page* 416b.)

TENSILE TESTS OF PLAIN AND TREATED RAILS

	Untreated rails. Head.	Untreated rails. Flange.	Treated rails. Head.	Treated rails. Flange.
Elastic limit.....	56,071	55,961	59,738	60,338
Ultimate strength.....	118,138	119,385	124,857	125,690
Elongation, per cent.....	12.8	15.4	13.1	14.4
Reduction of area, per cent.	14.3	18.5	15.4	18.2

Taking Care of Barrows and Trucks

National Founders' Association Points Out the Value of Proper Selection, Maintenance, and Safeguarding of Shop Conveyances

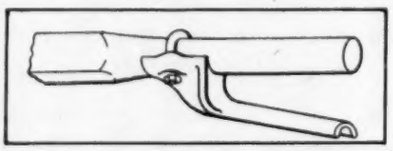
THE IMPROPER use of wheelbarrows or trucks is the cause of a great number of accidents. The committee on safety and sanitation of the National Founders' Association has issued a bulletin discussing the safeguards necessary to prevent these injuries. Some accidents arise because the wrong kind of barrow or truck is used for handling certain materials, or because the barrow or truck is of weak construction or in poor repair; some injuries are caused by the lack of handle guards for the protection of workmen's hands, or by unsuitable floors, pathways or runways over which the barrows or trucks are wheeled. For the most part, however, injuries received by workmen when handling barrows and trucks are caused by their own carelessness.

Wheelbarrows should be selected carefully for the specific work they must perform. There is a right barrow for every task, and usually the right one is the safest one. Barrows of comparatively light construction, built for handling coke, are unwieldy and excessively heavy when loaded with sand, cinders or coal; they will soon break down with such loads and may cause injury. Likewise coal barrows are too weak for moving castings; a small but strongly constructed barrow is necessary for this purpose. Barrows used for handling hot castings or cinders should be constructed of steel.

Consideration also should be given to the capacity of barrows. A barrow which is too heavy for a man to push easily when filled with materials may make him stumble or falter and upset the barrow with its load, and thus bring about harmful results. The excessive weight itself may cause an internal injury to the workman. On the other hand, if a barrow suitable for carrying a great deal of light material is used for carrying a small amount of heavy material, there will be waste of energy in pushing too much barrow and too little material. Such a barrow, because it is unwieldy, is not as safe as one of the right size and shape.

The proper balancing of the load will help to minimize injuries that may be caused by overstrain. Sometimes the method of loading material on the barrow will so balance the load that, when it is being wheeled, the greater part of the load will come upon the wheel and only a slight weight upon the man. But it is often impossible in this way to relieve the workman from *carrying* a weight which he should *push*, unless the barrow is carefully selected to hold in balance the material to be carried. Sometimes barrows with two side wheels may offer the advantage desired.

When intended for use on sandy floors in foundries or on soft earth in yards, barrow wheels with wide treads will promote safety because the wheel will not sink into the ground readily, thus minimizing the strain of pushing the barrow, as well as the danger of upsetting the load. Barrows with narrow tread wheels are lighter and are moved with greater ease when wheeled over hard floors or pavements. The diameter of the wheel or even the shape and length of the barrow handles affect the safety



KNUCKLE GUARDS FOR BARROWS

and efficiency of barrows. Special attention should be paid to the construction of barrows regularly employed to convey materials up or down inclines, because this work entails an added strain upon the man and an added chance for accident and injury. Similarly, when barrows are to be used for forward dumping of materials, they should be selected especially for this purpose.

In some plants it is the custom to hoist or lower barrows upon elevators. It then becomes advisable to limit the length of the barrow or its handles to allow ample clearance on the platform. It may also be wise to fasten suitable stops or sockets upon the elevator floor or to paint marks or lines to guide workmen in safely placing the barrows.

Frequently barrows must be wheeled through door openings or between piles of lumber, sheet steel, scrap, pig iron or castings which allow only a small space for passage. Workmen's knuckles and wrists are apt to be bruised or cut in striking doorways or other obstructions. In such cases, the handles of the barrows should be equipped with knuckle guards which can be purchased from barrow manufacturers or can be made in one's own foundry or from sheet metal. Such a guard is shown in the accompanying illustration.

To prevent undue wear of axles and bearings and to provide for easy and therefore safer operation, they should be regularly greased. This is frequently neglected.

All barrows are subject to damage by exposure to the elements and by ordinary wear and tear. Wooden barrows can be preserved longer by painting them frequently, and iron ones can be guarded against rust in the same way. Where practicable, barrows should be stored inside of buildings or at least under roofs. They should be stored in an orderly fashion, and not piled helter-skelter; their handles should not project into passageways and cause workmen to stumble over them. They should be inspected regularly. Barrows with worn axles, weak wheels, wabbly legs and unsafe handles should be taken out of service and assigned a space for temporary storage until they are repaired.

Storage of decrepit barrows in one place will facilitate quick repairs and induce the use of good parts of otherwise useless barrows, because such parts can be found most readily. It may also prove advantageous to keep a small stock of repair parts in the storage place. Where only one make of barrow is used, their interchangeability of parts will reduce the number and variety of parts which must be kept on hand. It is advisable to keep some extra barrows in stock to replace promptly such equipment as may become unsafe.

Danger is found in the use of narrow boards for barrow runways, either on inclines or across level openings, as from the ground to cars, or from cars to platforms or bins. Such runways should be at least 24 inches wide, substantially made, and with ends well secured, as a slight swerve in guiding the barrow or an unexpected movement of the plank itself may spill workman, barrow and load upon the floor or ground below. Such runways, whether portable or stationary, can be made safer by securing strips of wood or metal to their edges. These strips should project 2 inches or more above the surface. When used at an incline, where workmen are apt to

(*Continued on page* 416c.)

Making Sound Steel Commercially

A Discussion of the Effect of Impurities and Methods of Eliminating Them With Special Reference to Rails—Second of Two Articles

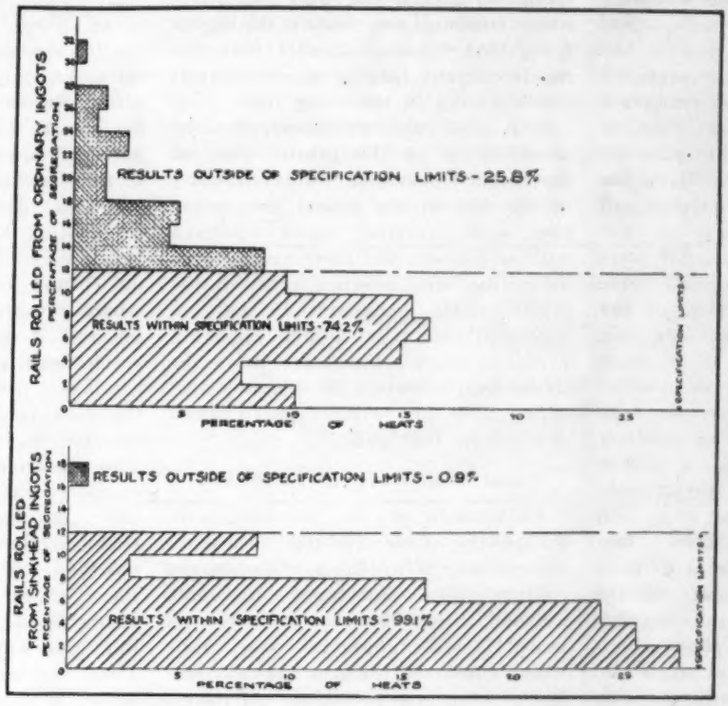
BY EDWARD F. KENNEY

THE WRITER has been experimenting for some years in the effort to develop some practical means of applying the benefits of the sink-head to the ordinary methods of steelmaking in commercial use. The principal essentials seem to be: (1) That the ingot be carried through the heating and rolling operations without the necessity of becoming cold; and (2) that sink-heads be of such type that ingots of varying weights can cast from the same ingot molds.

To get the solidity desired it is not necessary that the ingot become cold. There is little to be gained by carrying the temperature of the ingot through the range between the solidification point and atmospheric temperature, and there are very decided objections to it, chiefly the loss of heat, and cost of replenishing it, and the risk of damage to the ingot in reheating. Any betterment in quality obtained in allowing steel to become cold and then reheating through the critical range is much more economically and safely accomplished after the steel is in the form of a bloom.

The function of the sink-head being the preservation of a reservoir of molten metal on top of the ingot until all the body of the ingot has solidified, it follows that the non-conducting jacket should be kept on the top of the ingot when it is charged hot into the pits. The temperature of the soaking pits is lower than the freezing point of the steel, and there would consequently be a loss of heat from the sink-head even in the pits if there were no protecting jacket. The loss would be much less rapid than in an atmosphere at lower temperature, but the very fact that the ingots solidify throughout while in the pits shows that there is a considerable loss of heat from the molten metal. The proper thermal treatment of high carbon heats involves the use of comparatively cool soaking pits when the ingots are charged. It would be quite possible for the small mass of molten metal comprising the sink-head, if unprotected, to lose heat to such an extent that it would solidify before the greater volume of the ingot. The value of the sink-head in this event is gone, as on the further contraction of the liquid metal in the ingot there could be no feeding from the sink-head which had solidified.

Any large masses of slag-making material are objectionable in the furnaces because of the extra labor involved in keeping the pits clean, and, therefore, sink-heads of ordinary firebrick are not as available for use with ingots which are to be handled hot as for ingots which are allowed to become cold. It is true that the ordinary brick tops can be broken off before the ingots are charged, but this involves an additional operation, is objectionable on account of the dirt products, and, in addition, leaves the sink-heads without protection in the pits. Moreover, it must not be done until immediately before the ingot is charged, as the sink-head cools very rapidly in the air as soon as the covering is removed. If for any unforeseen reason the charging is delayed after such removal, the value of the sink-head is destroyed, and the ingot will be piped.


RAILS ROLLED FROM ORDINARY INGOTS
PERCENTAGE OF SEGREGATION
RESULTS OUTSIDE OF SPECIFICATION LIMITS - 25.8%
RESULTS WITHIN SPECIFICATION LIMITS - 74.2%
PERCENTAGE OF HEATS
RAILS ROLLED FROM SINK-HEAD INGOTS
PERCENTAGE OF SEGREGATION
RESULTS OUTSIDE OF SPECIFICATION LIMITS - 0.9%
RESULTS WITHIN SPECIFICATION LIMITS - 99.1%
PERCENTAGE OF HEATS

COMPARISON OF SEGREGATION IN RAILS ROLLED FROM ORDINARY INGOTS AND FROM SINK HEAD INGOTS

This loam used by the writer does not have to be removed from the ingot before the latter is charged into the pit furnaces, but can be allowed to remain on until the ingot is bloomed, being so plastic that it does not affect the rolling. The practice used in connection with these sink-heads is as follows: A wooden form of the dimensions of the sink-head extension desired is placed inside the metal sink-head casing, leaving a space of 2¼ inches wide between the form and the casting. This space is filled with moist loam, well rammed.

The loam and casing are then dried, the drying requiring about two or three hours in a pit oven. A number of wooden pegs around the bottom of the casing prevent the loam lining from slipping from the casing, while the whole is being handled and set on the ingot molds, and the steel is poured in the usual manner. When the metal reaches the sink-head, the wooden pegs are burned off, releasing the iron casing, so that it can be removed, leaving the loam lining attached to and protecting the sink-head against heat loss. The iron castings do not leave the open hearth,

A paper presented at a recent meeting of the American Iron and Steel Institute. The author, Edward F. Kenney, is metallurgical engineer, Cambria Steel Co., Johnstown, Pa. Accompanied by a discussion by Dr. Henry M. Howe, of Columbia University, New York.

being promptly removed and rerammed with fresh loam. The loam lining remains on the ingot until it is rolled, which insures against trouble which would result from delays in charging after the protective covering was removed, or the necessity of banking steel, or any of the many possibilities of commercial steel works practice, which interfere with the regular routine. In practice, this type of sink-head, besides being more efficient thermally, has been found much cheaper than the regulation brick, and, as stated above, has possibilities which make it much more applicable to ordinary steel works practice

Require Less Cropping

Inverted ingots with sink-heads permit a considerably greater economy because of the much smaller percentage of metal which has to be cropped from the top as compared with the cropping which is necessary with the ordinary ingot. This is shown in Fig. 12 in the previous installment of this article. Here are the photographs of four ingots, all poured from the same heat of steel under identical conditions. All were allowed to become cold, and were then slotted about one-third of the way through from either side and broken with wedges. *D* is an ingot of the ordinary shape; *B*, an inverted ingot; *A*, a similar inverted ingot which was equipped with an ordinary fire-clay sink-head, and *C*, a similar ingot equipped with the special sink-head consisting of an iron shell with dried loam lining. The brick sink-head has not been as large or efficient as desirable, but even it shows marked improvement in the resulting percentage of yield over the plain inverted ingot, and gives several times the yield obtained on the plain ingot. The steel used in these ingots was thoroughly deoxidized.

The value of the sink-head in getting a large percentage of solid steel from the ingot will be materially reduced unless we can regulate the size of the ingot to produce the amount of metal needed. In ordinary practice today this is easily accomplished by pouring the steel to any desired height in the molds. For instance, in most works producing rails, a single size of ingot mold is used, and ingots to economically produce any weight of rails are cast in the same mold. For 90-pound rails only about nine-tenths of the amount of metal is poured into a mold which would be poured if the same number of 100-pound rails were required. Similarly in other products, the weight of the ingot is varied to give the amount of steel required for a given product. Practically all sink-heads used in the past have been so designed that they were set at the top of the ingot mold, and no variation in the weight of the ingot was possible with a given mold. This feature would necessitate an extraordinarily large equipment of molds of various sizes, or else result in the scrapping of considerable quantities of steel. Both of these difficulties will be avoided by the use of a sink-head which can be set at any desirable height in the ingot mold in accordance with the amount of metal required in the ingot for its particular purpose.

This adjustable feature has been tried out in connection with the dried loam sink-heads, and is quite practicable. Several thousand tons of rail ingots have been cast with sink-heads which embodied this feature, the ingots being cast 7 inches shorter than the molds, thereby making a very considerable saving in the scrap loss.

It is practicable to provide for the conservation of the greater part of the original heat and the adjustability of the size of the ingots in connection with inverted ingots equipped with sink-heads, and there seems to be no reason why practically all of the piping steels could not be cast in ingots of this type without incurring excessive costs. For some years the writer has believed that this was possible, and his studies have been directed to that end.

Great Uniformity is Attainable

An example of the possibilities in the making of uniform steel in a commercial way is available in the recent rollings of rails for the Pennsylvania railroad. In 1914 the Pennsylvania issued specifications for steel rails which contained features radically different from any previously published. The most noteworthy of these was a series of tests to determine the degree of segregation as exemplified by carbon. The specifications required drillings for analysis to be taken from two points; one representing the outside of the head, and the other the junction of the web and head, of a section of rail cut near the top end of the top rail. The content of carbon, phosphorus, silicon and manganese found at the first-named point, marked *O* on the standard diagram, was required to be entirely within the limits specified, and failure to meet this requirement in regard to any one of the elements named rejected the entire heat. If the analysis of the drillings taken from *A* was found to meet the requirements, drillings from the point marked *M* on the diagram were analyzed for carbon, and if the carbon content found varied by more than 12 per cent from that found at *O*, all the top rails from that heat were rejected. Similar analyses were made of drillings from the point *M* on a section cut from the *B*-rail to determine the acceptance or rejection of all rails, and in the event of the rejection of all the *B*-rails, similar tests were made from sections representing the *C*-rails. The failure of the *C*-rail sample rejected the entire heat.

The point *O* was supposed to be fairly representative of the average of the heat, and the point *M*, while not being the center of the section nor the point of maximum segregation, was sufficiently near the segregation center to indicate the presence of any strongly marked irregularity in carbon content due to liquidation.

Slight Degree of Segregation

The degree of segregation was rather small. The carbon limits prescribed by the specification being 0.60 per cent to 0.75 per cent, the variation permitted amounted to 0.072 per cent at the low limit and 0.090 per cent at the high. In good routine work, determination by combustion made by two different chemists may vary 0.02 per cent. Closer work is possible where repeated checks may be run, but this is not practicable where the results must be reported promptly. In a rail mill it is not practicable to hold the rails pending extensive checking, because the mill would be blocked. This variation of 0.02 per cent when considered as being possible in either direction, and at either end of the chemical limits, meant that under a possible combination of conditions there might be available for actual segregation only 0.032 per cent at low limit and 0.050 per cent at the high. The specifications were afterward amended to allow a tolerance of 0.02 per cent to cover this possibility of variation in chemists' work in the event of one chemist obtaining results within the limits, the other outside.

These limits were very close, and rails which would meet such conditions would undoubtedly be very different from a large portion of the rails accepted under the specifications in common use. To meet the prescribed tests it was generally proposed to discard sufficient of the upper portion of the ingot to insure that the portion used be uniform within the limits required. Different steelmakers estimated that from 25 to 40 per cent of the ingot would require cropping.

Trials of the new specifications were made at two well-known rail mills and resulted in the rejection of considerable percentages of the rails rolled, but no large discards were made from the tops of ingots. The writer sug-

gested that the requirements of the specification could be met more economically by making use of inverted ingots equipped with sink-heads, which would permit the use of steel which by reason of its being thoroughly deoxidized would show little segregation. Such steel could not be safely cast in the type of ingots ordinarily used for rail steel, because of excessive piping, and because, as explained previously, the location of the piping cannot be predicted with any degree of certainty.

The results of the different efforts to meet the specifications in various ways are given in the accompanying table:

Column No. 1 gives the results obtained on Mill *A* using the ordinary practice of steelmaking and discard. Column No. 2 covers the second rolling at the same mill. Column No. 3 shows the results of the first rolling at Mill *B*, and No. 4, the second rolling at Mill *B*, using a somewhat different practice. Columns Nos. 5, 6 and 7 cover the different rollings to meet the specification, using inverted ingots equipped with sink-heads. The two earlier rollings of the sink-head series were made from ingots equipped with sink-heads too small to insure all the piping being included in the sink-head. These were gradually replaced by larger ones, and in the last rolling most of the sink-heads were of the proper size.

RESULTS OF ROLLINGS WITH PLAIN AND SINK-HEAD INGOTS

Cause.	Ordinary Ingots.				Sink-Head Ingots.		
	Mill A 1st Roll.	Mill A 2d Roll.	Mill B 1st Roll.	Mill B 2d Roll.	Mill B 1st Roll.	Mill B 2d Roll.	Mill B 3d Roll.
	1.	2.	3.	4.	5.	6.	7.
Piping	5.30	3.28	4.86	6.26	12.09	8.52	1.76
Drop test breakage	4.54	1.27	0.24	1.17	0.00	0.60	0.00
Segregation	8.84	16.52	11.40	7.40	0.00	0.00	1.04
A. O. analysis	20.80	19.81	12.30	3.24	0.00	5.51	0.00
Total rejection on test	39.48	40.88	28.70	18.07	12.09	14.63	2.80

The gradual reduction in the percentage of piped rails as the smaller sink-heads were replaced is clearly shown. The design of the small sink-heads was determined by experiment; the ingots were allowed to become cold and were then split. The small sink-head was ample to protect the ingots under these conditions, but in actual working conditions under which the ingots were stripped and charged into the soaking pits while some of the interior metal was molten, we found that the expansion of the outer walls of the ingot when heated seemed to increase the capacity of the ingot and required more metal in the sink-head. Measurements on a considerable number of 20 × 23-inch ingots before charging and after being heated showed an average increase in diameter of 0.3-inch, corresponding to an increase in volume of about 2.5 per cent. There is no doubt that with a sink-head of proper size, there will be no question as to the piped rails being entirely eliminated. These specifications are admirably adapted to detect and penalize segregation. Not only do they directly check on segregation in the requirement that the carbon at the point *M* on the standard diagram shall not vary more than 12 per cent from that at *O*, but they indirectly check on the segregation which results from such a severe penalty for the *O* analysis falling outside the specification requirements. In ordinary commercial ingots, in addition to an enrichment of the metal at the upper central part, there is generally an impoverishment in the segregating elements along the exterior near the top. The only guide the rail mill has as to the grade of steel in a heat is the ladle analysis. This ordinarily is a fair average of the heat, and if the analysis at the point *O* corresponds to the ladle analysis, the mill can safely apply steel based on the ladle. If, however, the *O* analysis does not agree with the ladle, rejection of the entire heat is likely to occur in spite of the ladle analysis being well within the requirements. In thoroughly deoxidized steel the *O* analysis agrees very closely with the ladle, having neither the central enrichment nor the exterior impoverishment.

The main feature of this specification centered around the chemical analyses, and in these experimental rollings, in order to determine whether or not such a specification was workable, a long series of chemical check work was done jointly by the railroad and the steel works' chemists. A special laboratory was fitted up at the works and the railroad chemists made their analyses concurrently with the working of the mill, and every determination was checked within 0.02 per cent in carbon before the final figures were reported. Similar close checking of the other elements was required. This is mentioned simply as an example of the close results which can be obtained even under the stress of the necessity of very rapid work, as the results had to be obtained promptly so as to avoid delays in shipping the rails. Using the railroad chemists' results, which must of necessity be considered decisive, the percentage of segregation which was found in the top rails was 9.29 per cent for rails rolled from ordinary ingots and 4.31 per cent for rails rolled from sink-head ingots. There is on the average more than twice as much segregation in the ordinary ingots as in the sink-head type. A more detailed comparison is shown in Fig. 13, which shows how much more uniform the sink-head ingots were. This diagram shows that 25.4 per cent of the analyses from heats cast in ordinary ingots were outside the rejection limits while less than 1 per cent of the analyses from sink-head heats were outside. Out of all the 5,000 tons of rails made from sink-head ingots, we found only one case where the segregation was sufficient to cause rejection, and we have reason to think this was due to an error in not following instructions, and not to anything inherent in the method of producing uniform steel.

By taking a large discard from the top of the ingot, fairly uniform steel can be obtained, but, as stated earlier, this is not economical, nor is it certain, as there are many ingots like ingot No. 4 in Fig. 5 in the previous installment of this article, in which there is segregation and a tendency to pipe sometimes 50 per cent or even more from the top of the ingot.

The Pennsylvania specification will not detect defects of this kind, although it is certain that it will result in a great betterment in the quality of the rails over those purchased under the usual specifications.

These experimental rollings of rails have been selected to show the possibilities of the inverted ingot in making steel commercially which is practically free from segregation, because the testing was so thorough and so well checked by the purchaser that there can be no question as to the results. Equally striking effects have been produced in the making of forging steels where the necessity of producing sound steel is probably more imperative in a commercial sense than in the rails. A small pipe may exist in a rail and not be detected for years, if ever. In the case of some forgings, crank shafts for instance, a great deal of expensive work may be done by the customer in forging and machining before he cuts out the throw. This operation is likely to disclose even the slightest pipe, and, if such is disclosed,

all the work done up to that time is wasted. The buyer of forging blooms can very economically pay a substantial extra for steel which can be guaranteed as sound, and an inverted ingot equipped with an efficient sink-head is the surest way to produce such steel.

In the past the steelmaker has often met exacting requirements by using only the lower portion of the ingot for product demanding what is generally considered exceptional quality, and applying the upper portion in the making of product on which special refinements did not appear to be necessary. Splice bars, tank plates, light rails, etc., were frequently made from the top cuts of ingots, and appeared to give satisfaction, but there is a general demand for better quality all along the line, and it is reaching all these products. The man who formerly bought flange steel whenever his work involved the slightest flanging operation, now orders tank steel and insists on it being capable of flanging; the splice bar, by reason of more severe service conditions and the demand that failures be eliminated, is now subject to stringent testing requirements. In fact, one of the leading railroads has very recently put out a specification for splice bars in which the requirements are as exacting as for the highest class of heat-treated forgings.

Such important alterations in the requirements of customers are changing the economic conditions in the steel works. If the discard has to be scrapped, a very much smaller discard will bring the cost up to the cost of improved casting practice, than would be true if the discard could be utilized for product, and the gradual and rapid restriction of the uses to which the upper portions of the standard ingot can be used is forcing more and more of the top cuts into the scrap heap.

Some cheap method must be developed to make a larger portion of the ingot available for the new and exacting requirements, and so certain are the results which have been obtained through the use of the sink-head that the writer believes some adaptation of it is the most promising means of achieving the result which is desired.

A Discussion by Dr. Henry M. Howe

LET US hope that this discussion will make it well, surely and publicly known that both those who decide the procedure in rail making and also their advisors are very keenly alive to their grave responsibility to travelers; that familiarity has not dulled them to the appeal of every victim of a rail breakage to leave no effort unmade to shield others from a death like his; has not clouded their perception that the rail maker who contributes to a human death by failure to do what lies in him to prevent by exercising his power, his knowledge, his skill and his inventive faculty, is to that extent accountable for that death.

The danger to life from the use of our common pyramidal and cold-topped rail ingots has been so long and prominently before us that we turn eagerly to Mr. Kenney's most promising plan for avoiding it.

His reason why wild steel segregates is certainly attractive, the supposed entraining upwards of the metal alongshore, enriched in the segregating elements, and the resultant concentration of those elements in the upper part of the axis. Yet on reflection we do not find this wholly satisfying. This lively movement ought to stir the metal up, to efface rather than to cause local enrichments. The lightness of these elements hardly counts. A spoonful of whiskey, if set skillfully on the surface of a glass of still water, remains in place pretty well. But stir the water ever so little, and the whiskey mixes with it and can never again be parted from it by any mechanical means. I incline to explain the freedom of quiet steel from segregating in a radically different way, by its leading to the landlocking type of solidification.

We conceive of two extreme types of solidification, the onion type, with the deposition of successive concentric layers one on another, and the landlocking type, by the outshooting of branching pine trees from the shores of the already solid layers. These outshooting pine trees lock between their trunks and branches the residual molten metal, with the result that each little pool thus trapped retains the whole of its carbon, phosphorus and sulphur, and no general migration thence of any part of these elements to an axial last freezing pool is possible. Thus it is easy to understand why this landlocking type of solidification opposes axial segregation.

Quiet leads in two ways to this landlocking. The first particle of iron which freezes out is much poorer in carbon than the molten metal from which it freezes, and this selection of course makes the shore layer of the remaining molten metal correspondingly richer in carbon than it was before the freezing began, and probably so rich that its freezing point is higher than the existing temperature. As a result, this shore layer cannot freeze, and no additional iron can freeze out of the molten and attach itself to the already formed solid layers till, by the slow process of diffusion, the layer of the molten in contact with them has become so poor in carbon that it can freeze at the existing temperature.

If now we imagine the two pine tree trunks have already formed and are projecting out into the molten, it is evident that this process of diffusion will lower the carbon content of the molten metal in contact with their tips more rapidly than that of the landlocked metal between their trunks, so that their tips will grow faster than their sides. But this is a condition which continuously exaggerates itself. The longer the trunks of the pine trees are, the more effectually do they shut off the molten metal about their bases from being so impoverished in carbon by diffusion as to become capable of freezing at the existing temperature.

This principle, which thus leads to the rapid growth of the pine tree tips, has already led to the formation of the pine trees themselves. Any slightest protrusion at any one spot on the surface of the solid layers at their contact with the molten, has a corresponding advantage over the concave spaces about it. Because it protrudes, it will the sooner have molten metal against it on which it can feed, that is to say molten metal poor enough in carbon to be able to freeze at the existing temperature. Hence from a slight protrusion it grows rapidly into an outshooting blade. Because it thus grows faster than the concavities beside it, it continuously increases its advantage. "To him that hath shall be given."

But this advantage which the first incipiency of a protrusion has is in large part lost if the metal is in rapid movement, because this movement feeds the concavities beside the protrusion almost as fast as the protrusion. The advantage which a protrusion has is very great if diffusion alone is to remove the carbon of the shore layer of molten metal which is unfreezable because too rich in car-

(*Continued on page* 416b.)

The author of this discussion, Dr. Henry M. Howe, is professor of metallurgy, Columbia University, New York.

Testing Spelter Coating in France

Use Apparatus Based on Theory That Amount of Spelter is Proportional to Hydrogen it Displaces From Acid

BY CHARLES COULON, WITH DISCUSSION BY J. A. AUPPERLE

A METHOD of determining the weight of spelter coating on galvanized sheets and wire, based on principles similar to those indicated by J. A. Aupperle in his article "Maintaining Galvanizing Standards", which was published in *The Iron Trade Review* of June 24, is used in France. Its application is simple and does not require the use of scales.

The sample is immersed in a 30 per cent solution of sulphuric acid in water. In such a solution, a cold temperature spelter is rapidly dissolved, the base metal being practically unaffected. Instead of weighing the samples before and after the operation, the hydrogen liberated is collected and measured. Its amount is naturally proportional to the quantity of spelter in the sample.

The apparatus used consists of a bottle which is closed by a tube. The lower end of the tube extends into the liquid. This lower end is surrounded by a shield which directs all hydrogen formed into the top of the bottle. As the gas is liberated by the action of the acid on the spelter, its pressure forces the liquid up the tube. The height of the column is proportional to the hydrogen liberated and therefore to the amount of spelter on the sample. The tube is graduated in milligrams of spelter.

This apparatus is called a zincometre. The test is so simple that any foreman can make it, thus being enabled to closely observe the character of his product. Comparisons of results obtained by its use with those secured by chemical analysis show but trifling differences. With this zincometre the amount of spelter coating from very small samples can be determined. The only problem is to secure samples of definite area. The best method seems to be the use of accurate punchings.

The zincometre permits a ready trial of samples showing the deposit of spelter on various parts of the product. The importance of such knowledge is obvious when one remembers that it is not the average coating that is the prime consideration, but the amount of spelter where the coating is thin. This method, like that of Mr. Aupperle, or any method of determining the amount of spelter deposited, is of great value in comparisons of coatings deposited under similar or identical conditions. But it is not to be further depended on. The value of a spelter coating depends not only on its thickness, but also on the quality and manner of application. The spelter is never absolutely pure, and variation in the proportions of its component metals is not without effect. The proportional amount of zinc deposit varies with the temperature of the bath, duration of immersion and the flux used. The iron itself is an important variable factor as well.

Some years ago, as engineer of one of the oldest galvanizing plants in France, I attempted to form definite conclusions as to the effect of tin in spelter. Considerable data was available on the durability of pieces galvanized from 15 to 25 years previously, the origin of the spelter being known. Some of this spelter was practically free from tin; another lot was remelted spelter containing from 2 to 4 per cent of tin. The most contradictory results were observed and it was impossible to draw any conclusions. I am, however, convinced that all observed anomalies may be readily explained when other conditions of fabrication are known. These include analysis of the spelter, temperature of the bath, duration of immersion and character of the flux.

Discussion by J. A. Aupperle

The discussion by Charles Coulon of my paper on "Maintaining Galvanizing Standards," which appeared in the June 24th issue of *The Iron Trade Review,* brings out some very interesting information as to the use of the zincometre as employed in France for the determination of the amount of spelter coating. The method he describes should give satisfactory results; although, in the writer's experience, sulphuric acid rapidly attacks various grades of spongy and poorly made ferrous metals, and for that reason it would be impossible to determine just when all the spelter coating had been dissolved. The writer's experience has also shown that it requires a longer period of time when sulphuric acid is used than when hydrochloric acid is employed as recommended by the writer.

While we have conducted no experiments to determine whether or not antimony chloride would be suitable in connection with the use of a zincometre and sulphuric acid as a solvent for the spelter coating it would be very interesting to know what results would be obtained with this modification. Mr. Coulon mentions the fact that the value of the spelter coating depends upon the quality of the spelter and refers to the iron content of same as being an important factor. We are entirely in accord with Mr. Coulon's statement and have found that the iron content of the coating on spongy, porous steel will be several times greater than the amount of iron occurring in the spelter coating on dense metals, such as ingot iron. Our experience has also shown that those spelter coatings containing a large amount of iron dissolve very readily in acids, alkalies and salts, and we have made tests with devices for measuring the amount of hydrogen evolved when galvanized coatings were tested in the above media and have invariably found that pure coatings are more slowly attacked than impure coatings.

Mr. Coulon believes that observed anomalies may be readily explained when the conditions of fabrication are known. We concur with Mr. Coulon in his observations along these lines, as we have found it very essential to observe the proper conditions to secure the best results when galvanizing sheets. Of course, when galvanizing steel, which is usually on a tonnage basis and on which no claims are made as to the quality of the spelter coating, either along physical lines or from a corrosion standpoint, the necessity for observing the minute details to produce good coatings is not necessary. The contradictory results which Mr. Coulon mentions as having been obtained when using remelted spelter may have been due to a large extent to the conditions of fabrication. Or what is just as probable, they may have been due to the fact that some portions of the steel were of a spongy nature while other portions may have been of a dense character, which would cause the iron content of the spelter coating to vary accordingly, with its consequent effect upon the rapidity of corrosion.

An interesting 32-page treatise on corrosion of steel, by D. M. Buck, metallurgical engineer, is published by the American Sheet & Tin Plate Co., Pittsburgh. The results of exposure tests of the company's line of sheet steel products are given at length, illustrations being shown.

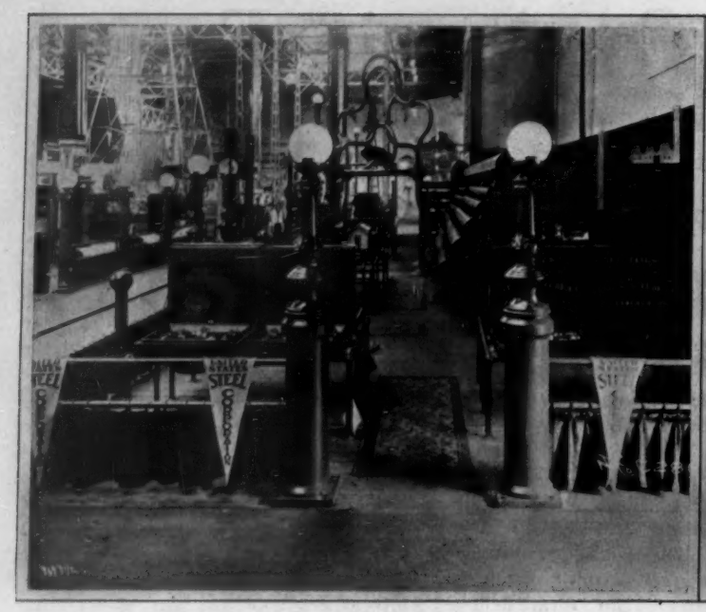


Fig. 1—Part of National Tube Co.'s Exhibit at Panama-Pacific International Exposition

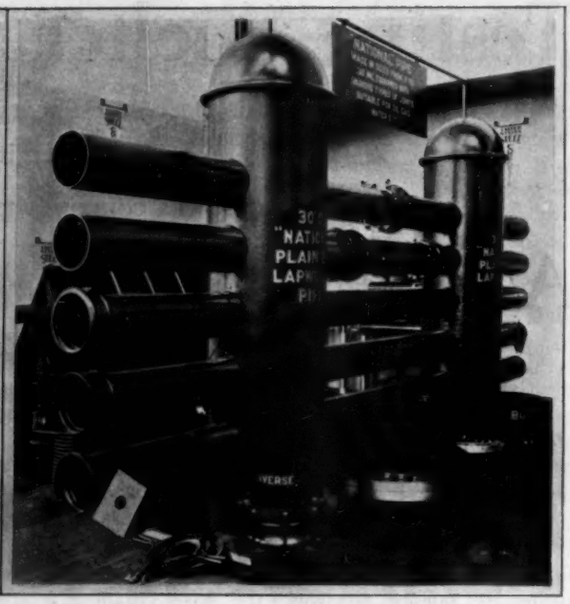


Fig. 2—Pipe Fitted With Several Types of Joints for Conveying Water, Oil, Air, or Gas

Bring Steel Industry to the Layman

Films and Models Attract Interest in Steel Corporation's Exhibit at Exposition—National Tube Co.'s Display Proves Popular

OCCUPYING a floor area of more than 45,000 square feet in the palace of mines and metallurgy, the United States Steel Corporation's exhibit is universally considered to be one of the most complete at the Panama-Pacific International Exposition. This may be readily understood from the fact that the exhibit is designed to give a comprehensive idea of all the activities and products of the Steel Corporation. Excellent views of the entire exhibit were published as a special insert in *The Iron Trade Review*, April 1.

More than a year was spent in the design and preparation of the exhibit. A crew of motion-picture men were employed all last summer in securing films of the important steps in the manufacture of steel products, from the mining of the iron ore in the Lake Superior district to the finishing processes in the Steel Corporation's mills at Lorain, O., Gary, Ind., and Pittsburgh. Six miles of film are shown at the exhibit.

The processes illustrated include prospecting for ore, stripping the barren soil covering the ore deposits, mining, loading and unloading ore carrying vessels, railroad transportation, unloading ore at blast furnaces, mining coking coal, manufacture of coke in beehive and by-product ovens, refining ore into pig iron, steel making

FIG. 3—MODEL EMERGENCY HOSPITAL, CONSTRUCTED ON FRAMEWORK OF NATIONAL TUBE CO.'S PIPE, WITH CEMENT COATING

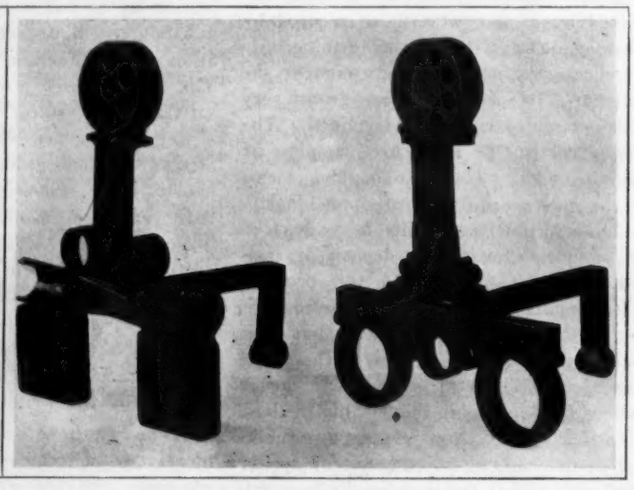


FIG. 4—ANDIRONS MADE OF SHELBY COMPANY'S SEAMLESS STEEL TUBING

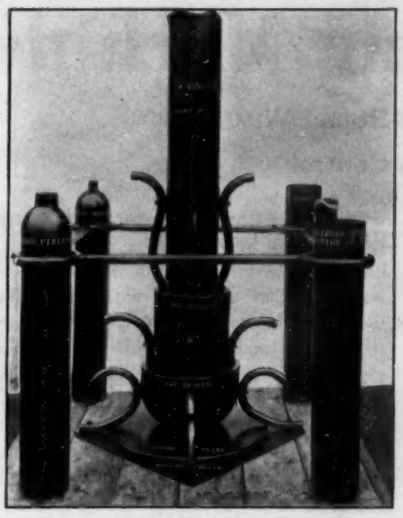


FIG. 5—STEPS IN MANUFACTURE OF SEAMLESS TUBING AND CYLINDERS BY CUPPING PROCESS

by the bessemer, open hearth and electrical processes, and rolling and finishing operations. These latter include the manufacture of pipe, seamless tubing, rails, cylinders, wire, wire fencing, sheets, etc. Other films show playgrounds and swimming pools maintained wholly or in part by the Steel Corporation for the children of its employes. A story entitled "An American in the Making" is also thrown on the screen. The films are supplemented by thousands of models and mechanical devices, illustrating processes of manufacture.

National Tube Co. Has Large Display

Representative of the subsidiary company displays which combine to make up the Steel Corporation's exhibit, is that of the National Tube Co., which occupies 6,000 square feet. This exhibit is divided into three sections; one section is set aside for pipe and allied tubular products; another for fittings and similar specialties, and a third for the Shelby Steel Tube Co.'s seamless tubing and cylinders. The entrance to the main section is through an arch 15 feet high, made of miscellaneous bends of National Tube Co. pipe. This, as well as the rack of pipe used in the oil fields, is shown in Fig. 1. The pipe at the top of the rack is said to be the largest and longest individual length of lap-welded wrought pipe ever made in America. It is 20 inches in diameter and 39½ feet long. Fittings and other specialties manufactured by the company are shown in the foreground.

Fig. 2 shows specimens of the National Tube Co.'s pipe fitted with various types of joints suitable for carrying water, oil, air, gas, etc. Several types of couplings also are displayed. The 30-inch pipe used in the supports is said to be the largest wrought pipe manufactured by the lap-weld process.

An interesting demonstration of National Tube Co. pipe used as a structural framework is afforded in the model emergency hospital, shown in Fig. 3. Cement over steel mesh is used in the construction. Fig. 4 shows a pair of andirons made entirely of seamless tubing. These andirons illustrate the successive steps in the manufacture of both cold-drawn and hot-finished seamless tubing, including the various processes from the billet to the completed product.

The method of manufacturing the seamless tubing and cylinders by the cupping process is further illustrated by the standard and railing shown in Fig. 5. This exhibit includes samples of the material in various stages of development, from the original, square, flat plate through the successive cupping processes to the finished cylinder. In Fig. 6 is illustrated a suite of mission style furniture apparently made of hardwood, but in reality composed entirely of seamless tubing.

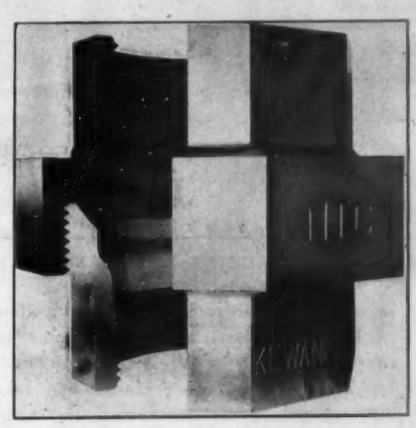


FIG. 7—MODEL OF 2-INCH OCTAGON UNION, ENLARGED 24 TIMES

FIG. 6—SUITE OF FURNITURE MADE ENTIRELY FROM SEAMLESS TUBING

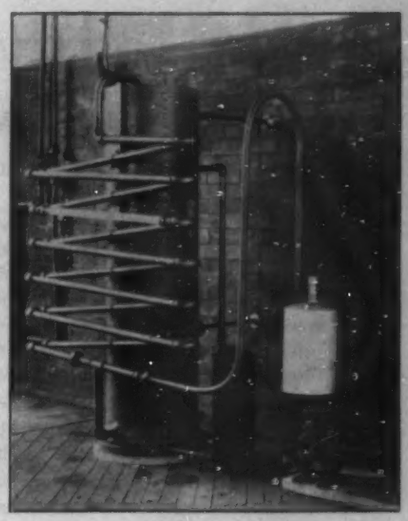


FIG. 8—OPEN HEATING SYSTEM USED FOR CORROSION TESTS

Enlarged 24 times to accurate scale, the huge model union illustrated in Fig. 7 has a section cut out to show various features of construction, including the brass to iron thread connection and joint seat, solid three-piece design and ease of disconnection. The National Tube Co.'s open heating system for corrosion tests, shown in Fig. 8, consists of a hot water tank, a water heater with thermostat, an air pump and several coils of pipe. Air is injected into the hot water, which is forced up through the coils into the tank, producing a comparatively rapid corrosion in the pipe. The object of the test is to obtain data on the life of various types of pipe.

Large Diesel Installation

An interesting power installation at the Panama - Pacific Exposition, San Francisco, is a 500-horsepower Busch Sulzer diesel crude oil engine in the machinery palace. The engine is direct connected to a 250-volt, 325-kilowatt, commutating-pole, direct current generator, manufactured by the Westinghouse Electric Mfg. Co., E. Pittsburgh, Pa. It is said that the cost of operating the plant is less than 68c per hour.

New Heavy Wire Drawing Machine

Bull Frame With 6-Foot Bull Blocks Turns Out Round Wire to 1¼-Inch Diameter—Has Friction Clutch Control

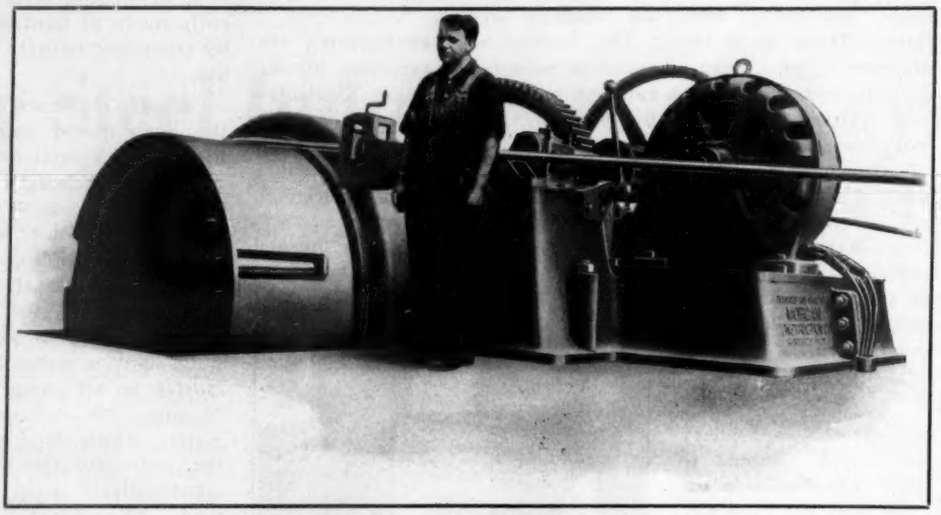
IN THE past few years there has been a decided increase in the demand for cold drawn steel products, including rounds, hexagons, and other sections finished from the rolled bar by drawing through dies to a section of great accuracy as to size and with a smooth, bright finish. This demand is largely the result of the development of automatic forming machines whose gripping dies require a smooth, clean and accurately sized bar. With such machines, as well as with cold drawing machines, the longer the bar the higher the efficiency, since such operations as starting, stripping the blocks and pointing rods for the drawing dies require a fixed amount of time. With the lighter cold drawn products, classed as wire, the length per 100 pounds is great and the efficiency of all handling machinery is relatively high. The efficiency falls off rapidly as the section increases and the length per unit of weight is correspondingly reduced.

Wire is handled in coils exclusively. Cold drawn material in large sizes has in the past been handled to a great extent in straight bars whose length is limited by considerations of space and convenience. The tendency of recent times has been to push forward the dividing line between wire and cold drawn bars, handling larger and larger sizes upon wire drawing blocks, straightening from the coil, when necessary, after drawing. The bull block has invaded the province of the straight draw bench to such an extent that it is now impossible to say at what size a cold drawn section ceases to be wire.

Much of the light shafting and screw stock in the market in sizes under ⅞-inch diameter is the product of heavy wire drawing blocks, straightened, cut to length, and sold in straight bars. Practically all the cold drawn rivets of the same size on the market are made up from the product of bull blocks. Bull blocks are also being used extensively for the drawing brass and German silver and for the roughing drafts on high carbon and alloy tool steels. Such products are given several drafts with intermediate annealing and the convenience of annealing in coils rather than in straight bars can readily be appreciated.

The heavy two-block bull frame shown in the accompanying illustration, built by the Morgan Construction Co., Worcester, Mass., represents a recent development in heavy wire drawing. It is said to be the most powerful machine of its class in existence and is built to produce round wire 1¼ inches in diameter, coiled on a 6-foot block. To take full advantage of the economies consequent to the use of bull blocks it is planned to draw the material in 1,000 pound bundles, handling it to and from the machine mechanically.

The Morgan Construction Co. makes it a practice to equip all its heavy wire drawing blocks with friction clutch control, placing a coil clutch inside each block, which, in addition to acting as a safety appliance by permitting the block to be stopped in the middle of a draft, affords a slow start to the wire and relieves the machine from the shock incident to commencing a draft. The control lever is double toggled so as to lock in both positions, and on account of the peculiar form of the clutch take-up, it requires no more effort to stop the block under load than to control it when idle. By an arrangement of gearing which is not shown in the illustration, it has been possible to equip the right hand side of the machine with a smaller block, 30 inches in diameter, arranged to handle smaller sections at a faster rate, the speed being about six times that of the larger block. The construction is such that the draft line is at the same level on both sides of the machine and the smaller block may be replaced at any time by a slow running 6-foot block duplicating the one on the left side of the frame. The machine is driven by a 100 horsepower Westinghouse motor. The illustration shows the 6-foot block undergoing a preliminary test in which a steel bar was reduced from 1¾ inches diameter to 1⅛ inches. The machine, with the steel shafting in the preliminary stage of the operation, undergoing the first turn about the block, as well as controlling levers, motor, gears, and die, is clearly shown. The interchange of larger and smaller blocks may be made, it is said, in a short time and without difficulty.



WIRE DRAWING MACHINE WITH SIX-FOOT BLOCK

Brashear Issues Appeal

Referring indirectly to the recent criticism of the management of the American Society of Mechanical Engineers, Dr. John A. Brashear, president of the society, has issued the following letter to the membership:

"The plan of combining the *Transactions* with *The Journal* was discussed at the annual meeting, Dec. 1914, and as a result, it was voted to submit the whole subject to the membership for a letter ballot. The publication committee and the council have been at work for over a year upon the subject of the publications of the society, but the question is so far reaching that they are not yet

(*Continued on page* 416c.)

Heating Soaking Pits by Electricity

Rapid Development of Heat-Treating Practice Opens New Field for Electric Furnace—Automatic Continuous Type Proves Serviceable

MORE than a quarter of a century ago the first commercial electric furnace was put into operation for melting steel. Since this early and crude development of electric melting and refining furnaces, there have been put into service more than 100 of these furnaces, ranging from 100 to 3,000 kilowatts.

A furnace that seems well adapted for reheating operations is the resistance type in which the material to be reheated is entirely separated from, and independent of, the resistance element in which the heat is generated by the electric current. In some heating operations the actual cost of heating per ton is less with electric furnaces than with combustion furnaces, while in some heat-treating and annealing operations the precision with which the operations are carried on must be the justification for the higher cost of electric heating. The principal advantage of electric furnaces over combustion furnaces for reheating are: More accurate temperature control, non-oxidizing atmosphere, saving in space, elimination of blast or stock, evenness of temperature throughout the heating space, simplicity of control, small amount of heat lost to the surrounding atmosphere and cleanliness of surroundings.

The type of furnace which seems to be destined to have a large commercial application in rolling mill operations is the soaking pit, and it is doubtful whether any gas fired pits of large size can compete in cost of operation with electric pits where current is supplied at the usual rates of electric current available for this service, provided the ingots are charged hot into the furnace. A heat balance sheet for a four-hole soaking pit holding sixteen 3½-ton ingots and having passed through it 648 tons per 24 hours would show the following results, assuming a wall loss of 500 kilowatts per hour:

With ingots stripped hot, the interiors being molten, no heat is required for the metal itself and the current consumption would then be 500 kilowatt hours per 27 tons of ingots, less than 20 kilowatt hours per ton of ingots soaked. On the other hand, with ingots averaging 1,650 degrees, the current consumption for 27 tons per hour would amount to 1,620 kilowatts per hour or a current consumption of 60 kilowatt hours per ton absorbed by the metal. To this should be added 40 kilowatt hours per ton as wall loss. Thus the current consumption for ingots charged at 1,650 degrees would be 100 kilowatt hours per ton. With cold ingots the heat absorbed by the metal will be 230 kilowatt hours per ton and with a wall loss under this condition of 185 kilowatt hours per ton, 315 kilowatt hours per ton would be the current required for cold ingots.

The rapid growth of the practice of heat-treating and a realization of the precision with which this treatment must be carried on in order to secure uniform results has opened a particularly desirable field for the electric furnace. A type of furnace well adapted to heat-treating which requires precision is the automatic continuous type, wherein the material under treatment when brought to the predetermined temperature is automatically discharged either into the air or into some quenching medium.

Small electric reheating furnaces are commercially feasible from a fuel standpoint alone, where the current consumption per ton is 400 kilowatt hours and the rate 1 per cent per kilowatt hour, compared with oil where the consumption per ton is 100 gallons at a cost of 4 cents per gallon, or natural gas with a consumption per ton of 12,000 cubic feet at 33 cents per 1,000 cubic feet.

Abstract of paper read by T. F. Bailey, president, Electric Furnace Co. of America, Alliance, O., at a recent meeting of the Engineers' Society of Western Pennsylvania.

Vulcan

BY JOSEPH HUSBAND

TEN years ago, the low dunes, a desert of yellow sand and beach-grass, stretched unbroken from the foot of Lake Michigan south to the headwaters of the Kankakee. Since the early days when the good Father Marquette was paddled slowly around the curving beach line to die finally on the Michigan shore, they have remained—a desert of soft colors in the summer, a sleet-swept tract in winter. A few miles north, on the western edge of the lake, a vast city, in a single century, was born and thrust its tower high against the horizon. Then, suddenly, came an instant transformation. Other cities, filled with the men of every nation, flattened the dunes into level streets. Along the lake shore strange structures of steel, reeking with smoke and blackness, streaked the sky with a cloud by day and a glare of furnaces by night. From a hundred meshing tracks the clamor of locomotives rose above the murmur of the city's streets. Steel, Vulcan, had usurped the wastes of sand and wiry beach-grass. Progress and industry stained the blue Indiana sky with the smoke of a thousand chimneys.

The long concrete slip slashed the beach lines. Beyond its mouth the lake, a brilliant ultramarine, pounded in before the north wind; but inside, the quiet water was tawny with riled sand and the stain of iron. Against the nearest dock an ore steamer rested its long, low body beneath the shadow of a steel trestle that reached out, far above it. With sudden motion a grab-bucket swung down on slender cables from the trestle and disappeared in the waist of the ship. In an instant it lifted on tightened cables, heavy with ore, and swung ashore with grinding vibration of wheels and electric motors, to drop

Inspiration

We who deal daily with the prosiac realities of steel manufacture sometimes become callous to its more picturesque aspects. No other industry in the world, however, contains a richer store of material for the artist. The splendid etchings of Joseph Pennell, which were published in the Jan. 7 issue of The Iron Trade Review, are a living example of the inspiration that finds its source in the light and energy of molten metal. The accompanying article by Joseph Husband, which we are reprinting through the courtesy of the Atlantic Monthly, further exemplifies the artistic and imaginative possibilities of the steel industry.

its contents on the ore pile that ran parallel with the dock. Like a mountain range the vermilion peaks of ore piled up above me, from the mouth of the harbor far inland, so high that behind them only the tops of the tallest furnaces appeared against the sky. From the scarred hills of northern Minnesota, down the length of Lake Superior and Lake Michigan, other steamers were bringing fresh food for the hungry furnaces. The reverberation of the mills rose sharp above the even cadence of the surf.

Martian Creatures Beyond the Ore

Like strange Martian creatures the blast furnaces squatted beyond the ore piles. Ample-waisted, they flanked it, and between their huge structures the long row of "stoves," high as modest skyscrapers, lifted their slender domes in even line. Beyond, a vast pile of coal reared black against white heaps of broken limestone.

Inside the steel structure which inclosed the furnace a score of blackened, half-naked men were molding huge troughs of sand to receive the surplus iron which would pour forth when later they "cast the furnace". Hot, and enormous in girth, the furnace filled the building. Inside, under forced draft, and at a temperature of 3,500 degrees, layers of coke, limestone and iron ore were undergoing their vital transformation. By the heat of the consuming coke the iron was filtering down in liquid flood, purified and refined by the flux of melted limestone.

From beneath the furnace a squat locomotive dragged a string of curious cars across a desolate field to the steel mills. On low trucks the ladles, like inverted cones, carried the liquid metal, —so hot that four hours might elapse before it solidified.

In the twilight of a long corrugated building the brick ovens of the open hearths stretched away into almost indefinable distance. Heat, fresh consuming heat, choked the air. And from chinks in the hearths a white light of indescribable intensity pierced my eyeballs.

The trainload of molten metal had arrived before us. Already a big-lipped ladle had been dragged by an electric engine into the gloom of the building, and up to the hearth-mouth.

The doors of the hearth were thrown suddenly open. A blinding whiteness streaked with saffron, and heat almost beyond endurance, made me draw back behind a column. A workman thrust a pair of deep-blue glasses in my hand. Slowly the great ladle bent forward. From its spout a trickle of fluid iron poured faster and faster until the white cascade, at full flood, seethed into the hearth-bath. A shower of sparks, strange flowery pyrotechnics, shot high into the gloom. Through the blue glass I peered into the hearth. Like an infernal lake it swirled and eddied, a whirlpool of incandescent flame. Leaping tongues of pink and lavender danced in the blue darkness. Shielding their goggled faces from the heat, the workmen cast lumps of rich ore into the hearth-mouth — black silhouettes of men against the blue glare of an uncanny firelight.

"They're going to tap a heat," shouted the assistant superintendent in my ears, his words sounding faint and fragmentary above the steady roar that filled the building.

On the floor below, an electric motor trundled an empty ladle into place beneath the rear of one of the hearths.

Then from the hearth, with a mad daze of brilliancy, 56 tons of molten steel began to disgorge itself. Once more I put on the blue glasses. Against the deep purple gloom of the building the stream of metal shot forward and bent in the soft curve of running water. Like pale moonbeams the sunlight rays from the glassless windows pierced the darkness, and sharp across them leaped the avalanche of steel, a flood of brilliant pink and blue that showered the room with a constellation of falling stars.

For a brief minute I took off the glasses. In the terrible glare of light all background disappeared. Gone were the dark shapes of the toilers beneath; gone the uncanny moonlight. Yellow, tawny, brilliant as the contact of an electric arc, the swirling metal scorched my vision. A halo of flame seemed to envelop the ladle.

It was full. Through the glass, again, it boiled soapy and seething, the crest of its wave-tossed surface crimson and blue. Slowly from the crane above, two great hooks, like bent fingers, caught the handles on its sides, lifted it, and with a hail of sparks and a glare of heat against our faces, swung it far above us. Then, with grinding reverberation, it moved past, far down the long gallery, to be poured into ingots in the waiting molds.

In the blooming mill there was the continuous rumble of mighty thunder. Cherry red against the darkness, the incandescent ingots of steel shot back and forth between giant fingers that pressed and worked them at every passing; for like dough that must be kneaded to acquire a certain consistency, steel must be worked to obtain those qualities which its ultimate purpose will demand.

Into a great plank a hundred feet long the solid ingot flattened resistlessly between the stroking rollers. Then, finished, it shot abruptly beneath a knife that snipped it lightly into even bars of manageable weight.

In the structural mill the billets of steel, still malleable with glowing heat, rumbled noisily back and forth on the metal floor, propelled invisibly by countless whirling rollers that shot them with incredible speed and certainty of direction. As I looked down the length of the gloomy building, the glare of the moving bars of metal contrasted so sharply with the black floor that they alone were visible, like strange illuminated bodies that floated and swam on a sea of inky water. Through devious channels they navigated, palpably changing, narrowing, lengthening, until at last, in the far end of the building, the finished angle-bar or I-beam was deposited, a perfect thing, of cooling lead-gray steel.

Forming Spikes

And still more buildings; parallel with each other; equally vast; filled with darkness and tumult, the shifting shapes of giant roof-hung cranes, and the red glow of heated metal. Like paste from a tube, a thin rope of white-hot steel emerged from a shapeless machine that crouched squat on the iron floor, and with a breath of heat disappeared in the breast of another monster that trembled with the reverberation of a hundred hammers. And faster than the hand of my watch could count the seconds, a hail of railroad spikes, still glowing, leaped finished from its thundering womb. Bolts, spikes, nuts, and rivets, madly, with the tumult of clashing steel, poured finished from the vitals of the uncouth machines.

Plates of steel for the flanks of ships which will some day transport the wares of a trading world. Rails and spikes to carry high over mountain passes the flitting trains that make distant cities one. Bolt, rivet and girder for the towering building. Steel, steel for its multifold destinies, here it is born in heat and labor. Steel for an age of steel.

In the twilight of the late summer afternoon the world seemed strangely quiet and at peace. Sharp and black against the yellow sky the roofs and stacks of the mills rose like the sky-line of a ruined city; and in an occasional opening the blue lake gleamed with the brilliant light of sapphire. In the gathering darkness electric lights began to glimmer. Flares of dull-red gas-flame burst out like volcanoes and suddenly were gone.

Loud and metallic a hurdy-gurdy lifted the rippling cadence of a Neapolitan air in a distant street. Beyond the mill-yard gates the saloon windows shone gayly and arc lights trembled into life. Day was over.

Money and Iron: Fact and Comment

Further Threatened International Complications Cause "War Babies" to Decline—Financial Notes

PRACTICALLY all the so-called war stocks suffered heavy declines following the sinking of the ARABIC and threatened complications with Germany. Both Bethlehem Steel common and preferred lead the list with declines of 16 and 13 points, respectively, while Continental Can common was off 9 points for the week. United States Steel common declined 3¼ points and preferred, 2 points. In spite of the repeated announcement of the remote possibility of dividend declarations on some of these common shares, speculation continues heavy. The future is being discounted and heavy profits are anticipated from the large orders now being filled. Notwithstanding the unusually favorable crop outlook, railroad shares are not participating to any extent in the upward price movement and for the first time representative industrials are quoted on a higher basis than railroad shares. It is evident that industrial stocks temporarily have replaced rails, not only with the speculators, but also with the investing public.

The demoralization of European exchange was a factor in introducing some irregularity, although its effect was discounted to a large extent. Among the stocks not quoted on the New York stock exchange, Youngstown Sheet & Tube, Youngstown, has reached 190, while La Belle common was quoted at 36. Wellman-Seaver-Morgan common was bid at 35, and more activity is noted in the lesser dealt-in shares. The placing of war orders continues heavy and every effort is being made to secure idle plants satisfactorily equipped for this work. The steel companies are unable to meet requirements, so heavy are the demands for steel rounds for prompt shipment. Some of the plants not provided with bar rolling mills are contemplating the installment of equipment of this kind and while several projects are in contemplation they have not yet reached the contract stage. Negotiations now are pending between American and English makers which may lead to the placing of a large loan in this country, although it is certain that nothing definite will be done until after the sentiment covering an undertaking of this kind is ascertained.

Quotations at the close of business Aug. 21, and changes in the leading stocks identified with the iron and steel business are shown in the following table:

	Close Aug. 21.	Net change.
American Brake Shoe & Fdy. Co. ctfs.	103	— 2
American Brake Shoe & Fdy. Co. ctfs., prfd.	...	..
American Can	56¼	— 3¾
American Can, prfd.	105	— 1¼
American Car & Fdy. Co.	64	— 6½
American Car & Fdy. Co., prfd.	118	+ ⅛
American Locomotive	49½	— 5⅛
American Locomotive, prfd.	98	..
American Steel Foundries	47⅜	+ 3⅜
Baldwin Locomotive	76	— 4¼
Baldwin Locomotive, prfd.	105½	— ½
Bethlehem Steel	274	—16
Bethlehem Steel, prfd.	141	—13
Colorado Fuel & Iron	37¼	— 3¼
Continental Can	83½	— 9
Continental Can, prfd.	104	+ ½
Crucible Steel	69	— 3⅜
Crucible Steel, prfd.	101⅛	— ⅞
General Electric	169	— 2⅛
International Harv. of N. J.	105½	— ¼
International Harv. Corp.	...	..
International Harv. Corp., prfd.	...	..
Nat'l. Enamel'g. & Stamp. Co.	24½	— 3⅛
Nat'l. Enamel'g. & Stamp. Co. prfd.	89	+ 1¼
Pressed Steel Car	56	— 6¾
Pressed Steel Car, prfd.	100⅞	— ⅛
Pullman Palace Car	157	— 5
Republic Iron & Steel	40½	— 3¼
Republic Iron & Steel, prfd.	100	+ 1½
U. S. Cast Iron Pipe & Fdy.	20¼	— ¼
U. S. Cast Iron Pipe & Fdy., prfd.	47	..
United States Steel	70⅝	— 3¼
United States Steel, prfd.	110¾	— 2
Westinghouse Mfg.	111¼	— 1⅜

War Contracts Delayed

Delays in arrangements for adequate American credit to finance contracts for munitions of war are responsible for a certain "show me" attitude on the part of machine manufacturers in Cleveland and its vicmity, declares an investment broker of that city who has recently been active in the placing of war orders. A contract for 500,000 rifles, with 2,000,000 more to come, has been hanging fire for nearly a week. Ample machine shop and woodworking capacity has been found to handle the order, but the stipulation of "25 per cent, cash down" is still unsatisfied. No doubt is felt that the matter of credit will be satisfactorily settled in a short time, but just at present it is causing no little trouble in negotiations.

Financial Notes

The New York Air Brake Co. has declared the regular quarterly dividend of 1½ per cent, payable Sept. 24, to stock of record Sept. 1.

The Haynes Automobile Co., Kokomo, Ind., has increased the number of its directors and has increased its capital stock from $600,000 to $1,200,000.

The General Electric Co. has declared the usual quarterly dividend of 2 per cent, payable Oct. 15 to holders of record Sept. 4.

The Canada Foundries & Forging Co., Ltd., has resumed dividends, the directors having decided to pay 1¾ per cent for the quarter ended July 31, 1914, being the dividend deferred at that time, and 1¾ per cent for the quarter ended Aug. 31, 1915. The 3½ per cent dividend was paid Aug. 16.

The National Electric Welder Co., Warren, O., manufacturer of spot, butt and seam welders, advises its recent increase in capital stock was to take care of increased business. The company purchased a building ready to move into, and all equipment already is installed.

Involuntary bankruptcy proceedings have been begun against the Elwood Iron Works, Elwood, Ind., in federal court. The company is insolvent, it is alleged in the petition filed by the Toledo Furnace Co., the Jones Hardware Co., Richmond, Ind., and E. T. Silvixus, Indianapolis. The petitioners say the company owes them $767.40.

The South Side Trust Co., Pittsburgh, has been appointed receiver for the Pittsburgh Emery Wheel Co., which has a plant at Rochester, Pa., for the manufacture of emery wheels.

The New Milford Cold Rolled Steel Co., New Milford, Conn., has filed a petition in bankruptcy in the United States district court at Hartford, Conn., showing liabilities of $38,342.05, and assets of less than $2,000.

The Republic Iron & Steel Co. has refunded all outstanding notes by the sale of 5 per cent bonds to Blair & Co. The notes have been paid off by the sale of these bonds, which means the completion of Republic financing. The notes paid off and cancelled aggregate $2,000,000 and the bonded debt of the company, which is a first mortgage obligation, now amounts to approximately $17,000,000.

The Wile Electric Furnace Co., Jenkins Arcade building, Pittsburgh, has received an order for an electric furnace having a capacity of 1,000 pounds per hour from the Copper Clad Steel Co., Pittsburgh, with works at Rankin, Pa. The company recently was incorporated with a capital of $250,000 for the manufacture of copper clad wire, for high tension lines. The Wile company also has received an order for a 10-ton electric furnace for W. A. MacKay, St. Johns, N. F.

Shell Contract

War Order Illustrates Business Methods of Allies' American Agents

In view of the many contracts for munitions of war now being placed with American manufacturers, it is interesting to note the methods employed by the representatives of the allied belligerents in granting these orders. An actual contract for high explosive shell bodies, recently drawn up between an accredited agent of one of the allied powers and a large manufacturer, is reproduced below. It is typical of the agreements now being signed by many American manufacturers with agents and sub-agents of the triple entente:

Memorandum of agreement made this ..... day of ..... A. D., 1915. Between ..... and .....

Quantities

Five hundred thousand shells (500,000).

Price

Four dollars and eighty cents each ($4.80).

Specifications

Seventy-five millimetre French high explosive shell body, including the nose cap, firing band and shipping plug. Specifications to be as per attached memorandum for this class.

Total Amount

Two million, four hundred thousand dollars ($2,400,000.00).

Quantities per Month

December, 1915 10,000
January, 1915 15,000
February, 1916 15,000

and the balance in equal monthly shipments thereafter, the final shipment to be made by December 31, 1917.

Inspection

All inspections to be made by representatives of the purchaser at the factory of the seller. In case of a dispute over the finding of the inspector, the decision of a referee or umpire appointed by the bureau of ordnance of New York is to be accepted by the parties hereto. The fees of such referee are to be paid by the loser of such decision. In the event of a dispute, all penalties provided for herein are to be suspended until the decision of the umpire.

Deliveries

The seller when ready to deliver the quantities to be delivered in each month, shall notify in writing the purchaser. The seller shall be given written instructions as to the shipment of such high explosive shells provided that in the event that such instructions are not received within ten days after the notice of the seller of its readiness to deliver, the said shells may be put in storage for the account of the purchaser. Storage charges, if any, shall be borne by the purchaser.

Delivery Points

The seller agrees to deliver f. o. b. its works, with freight allowance to New York.

Payments

Twenty-five per cent of the total amount of the purchase price shall be paid to the bank of the seller (approved by the purchaser) in cash by the purchaser within two days of the signing of the contract. The fund for the payment of the remaining 75 per cent of the shells to be delivered hereunder will be provided by the establishment of a confirmed irrevocable dollar credit with some bank or banking house in New York, approved by the seller, and payments under the credit shall be made upon presentation of invoices in triplicate accompanied by bills of lading, the proper certificates of inspection; or in case shipping instructions have not been given as hereinbefore provided, instead of bills of lading, there may be substituted receipts signed by the seller to the effect that deliveries are being held in storage to the order of the purchaser. The 25 per cent advance payment made by the purchaser shall represent the last payments made on deliveries under this contract, and the remaining 75 per cent shall be paid by payments being made in full for each of the first 75 per cent of the deliveries made under this agreement out of the fund hereinbefore set out.

Guaranty

The bank of the seller shall by proper instruments on that behalf, bind itself to the banking house with which the aforesaid dollar credit is provided that so much of the amount of cash advanced by the buyer and paid into the bank of the seller will be refunded to the aforesaid dollar credit banking house in the event of non-delivery or shipments in payment for which such cash was advanced.

Penalties

The seller agrees to make the deliveries herein provided for within the time limited herein and agrees to pay as liquidated damages for each day more than 30 days that it shall be late in making deliveries, ¼ of 1 per cent of the value of all high explosive shells that it shall have failed to deliver within 30 days of the time, when, under the terms of this contract, such delivery is due, it being however, expressly understood that should such failure to deliver such shells be due to a breakdown in the seller's plant, or to strikes, the destruction of its plant by fire, explosion, or result from other unavoidable causes, or the act of God, that the penalty provided for herein shall not apply, but in that event this contract shall be suspended during the time of such disability on the part of the seller to make deliveries. Provided that the total penalties under this agreement shall not exceed 5 per cent of the value of all shells contracted for hereby, and that no other penalty may be exacted.

Packing

The high explosive shells are to be packed in containers conforming with the regulations of the interstate commerce commission. The containers are to be marked on the outside in letters plainly visible.

Bethlehem Steel Activities

Reports from South Bethlehem state that another blast furnace has been blown in, making five out of six furnaces in operation. The open-hearth furnaces are running at 100 per cent and work is being pushed on a new battery of steel-making equipment of this type in the Lehigh plant. Operations have been started in the new 22-inch mill of the merchant bar department of the Lehigh plant. The 12-inch and 10-inch bar mills began operations several weeks ago.

Takes Over Plant

Driggs-Seabury Change Effective Sept. 1

The Driggs-Seabury Ordnance Corporation, Sharon, Pa., will be taken over by the Driggs-Seabury Co. of New York. Incorporation papers for the latter were taken out at Dover, Del., under the laws of Delaware, Saturday, to engage in the manufacture of iron and steel shrapnel projectiles, cannon shells, firearms and all kinds of war materials and munitions. The capital stock was given at $4,000,000. President John Stevenson Jr., of the old company, is a noted peace advocate, and had refused to accept orders for munitions for foreign belligerents, the plant being engaged in the manufacture of auto trucks and automobiles. Later, however, he gave out the following statement:

"The Driggs-Seabury Ordnance Corporation, of Sharon, Pa., has agreed to sell its assets to the Driggs-Seabury Ordnance Co. of New York, the agreement taking effect the first of September. The present stockholders of the Pennsylvania Driggs-Seabury company will take stock in the new enterprise to the full extent of their holdings. The New York company will supply additional capital wherewith to enable the Pennsylvania Corporation to handle a larger volume of business than it now is doing."

A. E. Borie, former vice president of the Bethlehem Steel Co., and later chairman of the Taylor-Wharton Iron & Steel Co., High Bridge, N. J., is said to be the choice for president of the new company and W. L. Wright, formerly vice president of the Keystone Watch Co. will be vice president and general manager. The directors, in addition to the two officials named, will be: George W. Burleigh, E. C. Delafield, James Imbrie, John C. Jay Jr., J. C. Stevenson and John Stevenson Jr. The last named will be chairman of the board.

Lackawanna Plant Busy

Buffalo, Aug. 24.—The Lackawanna Steel Co., Buffalo, operating its large plant to the limit of its ingot capacity at the present time, is about to put into commission four new standard open hearth furnaces, which are rapidly nearing completion. Officials of the company expect the new furnaces to be started by Sept. 1.

With this increase to its furnace capacity, the Lackawanna plant will have a battery of 18 standard open hearth furnaces, two large Talbot tilting furnaces and seven blast furnaces,

all in operation. The mill capacity of the plant is in excess of its furnace capacity, so that the increase in the number of going open hearths will simply add that much to the productive capacity of the large mills.

Officers of the company here declined to discuss the report that the Lackawanna Steel Co. has just divided with the Steel Corporation a Russian order for 200,000 tons of 42-pound rails.

Freeze Out

Is Strongly Suspected by Smaller Canadian Manufacturers

Toronto, Aug. 24.—Shell manufacturers are still complaining that the orders necessary to keep their plants in operation are not forthcoming, and an impression obtains in some quarters that the withholding of orders is due to a desire on the part of some of the larger manufacturers to monopolize the industry and freeze out the smaller men in the business. That there is some grounds for this view is indicated by the utterances of D. A. Thomas, the British government representative, who in an interview at Halifax, in discussing the question of policy for the future, said: "Rather than creating a number of new and smaller factories it may be better to give the orders to the larger places where experience and equipment can insure rapid and satisfactory production." As the larger interests are strongly represented on the shell committee, which has the giving out of orders, it is altogether likely that this plan will be followed. While much may be said in its favor on the score of efficiency and quickness in deliveries, it will none the less entail serious hardships on numerous small manufacturers scattered throughout the country who have been induced to equip their plants for shell manufacture.

Foundation Contract Placed

The John F. Casey Co., Pittsburgh, has received the contract for the construction of foundations for a new blast furnace at Canton for the United Steel Co. Pickands, Mather & Co., Cleveland, are interested in the furnace.

Otto and Sol Krupp, of Carey, O., have purchased the machine shop of W. H. Phelps, at Upper Sandusky, O. The plant will be placed in operation on war orders recently secured by the new owners.

Zinc Refiners

Secured by Canadian Bounty and Profitable Prices

Toronto, Can., Aug. 24.—The problem of securing a supply of zinc refined in Canada from domestic ores which has been for some time engaging the attention of the shell committee and the Canadian government, has been solved by an arrangement with Canadian producers and the adoption of a scale of bounties on refined zinc to take effect under certain conditions, so as to secure refiners against loss in case of a sudden fall in prices. Owing to the high price of zinc in the United States and the uncertainty of a steady supply from that source, the government has been very anxious to encourage the starting of Canadian refineries. Capitalists, however, have been reluctant to incur the expense involved unless guaranteed against loss from the fall in prices anticipated at the close of the war. To meet this difficulty the Canadian government has issued an Order-in-Council of a tentative character providing for bounties on refined zinc containing not more than 2 per cent impurities on a sliding scale not exceeding 2 cents per pound. The bounty will not be payable unless the standard price of zinc in London falls below £33 per ton, nor upon zinc produced during the progress of the war, or after July 31, 1917, or upon zinc contracted for by the shell committee at a price of 8 cents per pound or over, and the total amount to be paid in bounties is not to exceed $400,000.

The shell committee is prepared to pay the refiner 8 cents per pound or more during the continuance of the war, and it is considered that with this business assured, and the operation of the bounty in case hostilities cease within two years, the refiners will be secured against loss on the construction of their plants. The shell committee has already contracted for several thousand tons of zinc at reasonable rates. The government has under consideration a similar plan to encourage the establishment of Canadian copper refineries.

Spelter Plant Progressing

The erection of a new spelter plant for the United States Steel Corporation at Donora, Pa., is progressing rapidly. The Dravo Contracting Co., Pittsburgh, has practically finished the construction of building foundations. The main and auxiliary buildings, which will be erected by the American Bridge Co., will require about 7,500 tons of steel. The plant will contain 10 furnaces and will be ready for making spelter Jan. 1.

New Mills for Bethlehem

Plans have been issued and bids are being taken by the Bethlehem Steel Co. for the construction of important extensions to its Saucon plant, South Bethlehem, Pa., which will house additional structural steel capacity. Two new standard shape mills are to be installed, one of the 18-inch and the other of the 12-inch type. The company also has had in contemplation for some time the installation of a second Grey universal mill for the rolling of the so-called smaller Bethlehem shapes, but no decision yet has been reached as to when this betterment will be carried out.

Pratt & Whitney's New Office

The Pratt & Whitney Co. has opened an office and showroom at 16-18 Fremont street, San Francisco. S. G. Eastman, formerly manager of the company's Chicago office, is in charge. A large stock of Pratt & Whitney machinery, small tools and gages will be carried. The company has been appointed agent for the entire Niles-Bement-Pond line of machine tools, cranes, steam hammers, etc.

Big Machine Tool Inquiry

The Factory Appliance Co., Illuminating building, Cleveland, has received an inquiry from one of the nations at war for 60 engine lathes for turning shells up to 6 inches in diameter, 6 lathes for drilling artillery gun barrels, 3 automatic screw machines, 15 turret lathes, an hydraulic forging press of 200 tons capacity and other tools, including grinding machines, milling machines, pneumatic hammers, small steel rolling mills, etc.

The Firth-Sterling Steel Co., McKeesport, Pa., is sending to the trade a 4-page folder entitled "The Meaning and Power of Words", which defines the two words forming the title of this company, namely, "Firth" and "Sterling".

The Steel Company of Canada is arranging to install two new open hearth furnaces in its Hamilton plant which is kept very busy and is turning out from 12,000 to 15,000 forgings and from 500 to 1,000 shells per day.

Uncertain Delivery Slows Market

Foreign Demand Continues Unabated—Crane Inquiries Are Forging Ahead and Tool Contracts in Cincinnati Find No Takers

ACTIVITY in the machine tool market shows a noticeable falling off. This is due entirely to the difficulty of securing deliveries on all kinds of tools for making munitions. Demand for such machine tools continues in exceedingly large proportions. The prospective buyers, however, when they learn that they cannot secure deliveries of good-sized numbers of lathes, turret lathes, automatic and hand screw machines, etc., for many months ahead, naturally are slow to commit themselves. In many cases the manufacturers of such machines are sold ahead as far as next March. Most of the machine tool demand now is from abroad and large inquiries which are current involve shipment to France, Russia, England and other countries. The domestic demand for machine tools for making munitions has reflected few spectacular transactions during the past week. Perhaps the most important buying was that done by the American Car & Foundry Co. This interest has bought up a large number of heavy lathes and axle lathes and continues in the market. Outside of the demand for machine tools for making munitions the domestic market is even more quiet than in preceding weeks. About the only new development in the railroad end of the market is the distribution of orders for a few tools by the Chesapeake & Ohio.

The crane market continues active. The Fore River Ship Building Corporation has purchased eight Niles cranes, leaving three cranes for which it still is in the market. The Bethlehem Steel Co. has purchased five 10-ton and one 40-ton Pawling & Harnischfeger cranes and one 10-ton Niles crane; the Bethlehem Steel Co. has put out additional inquiries making 12 cranes for which it still is in the market. The Baltimore Car & Foundry Co. has bought two Shaw cranes. The Wm. Cramp & Sons Ship & Engine Building Co., the Alan Wood Iron & Steel Co., and the Crucible Steel Co. of America all have placed heavy orders for cranes with the Morgan Engineering Co., but details are not yet available. The Pawling & Harnischfeger Co. has booked the following cranes: Two 15-ton and one 10-ton for the Bartlett-Hayward Co., Baltimore, one 10-ton for the American Car & Foundry Co., one 5-ton for the Warren Foundry & Machine Co., Phillipsburg, N. J., one 10-ton for the Balbach Smelting & Refining Co., Newark, N. J., and one 10-ton for the American Smelting & Refining Co. The Alpha Portland Cement Co., Easton, Pa., has ordered a Niles bucket handling crane. The Browning Co. has booked an eight-wheeled locomotive crane for the Newport News Ship Building & Drydock Co., and a similar crane for the Baldwin Locomotive Works; also three 30-ton locomotive cranes for the Pennsylvania railroad, for installation at Greenville, Jersey City. The Lake Torpedo Boat Co. is in the market for several 3-ton electric traveling cranes.

Crane Inquiries Supersede Demand for Tools

PITTSBURGH sellers of electric cranes are enjoying the heaviest volume of business experienced in many years, some agents saying all previous records were broken in July. The McKeesport Tin Plate Co., the Standard Tin Plate Co., the Jones & Laughlin Steel Co., the Carnegie Steel Co. and the Youngstown Sheet & Tube Co. and several other concerns have purchased in the neighborhood of 50 cranes since June 1. The Youngstown Sheet & Tube Co. is expected to award contracts within the next few days for five or six cranes of 10-ton capacity each for a new bar mill. The Pittsburgh Piping & Equipment Co. has taken a 10-ton Case crane, and indefinite inquiries for three open hearth steel plant cranes have come out this week. The Carnegie Steel Co. has entered the market for some auxiliary equipment for its rail mill at Braddock, Pa., and it is understood an independent steel concern is considering plans for the erection of a new bar mill. The Steel Car Forge Co., Frick building, Pittsburgh, will build a new machine shop at Ellwood City, Pa., for which a number of metal working tools will be purchased. The Buffalo Copper & Brass Rolling Mill Co. plans to erect a $150,000 addition to its plant. The Union Switch & Signal Co., as previously reported, has been figuring prominently in the market for machine tools for the manufacture of war materials. Sellers of tools appear more concerned about deliveries of equipment, contracted for some time ago, than in new undertakings.

Characteristic Lack of Tools in Cincinnati

REPRESENTATIVES from the French and Italian governments are in Cincinnati to buy $100,000 worth of lathes for prompt delivery. About one-third of these will go to France and the other two-thirds to Italy. They have not been able up to the present time to find any machine tool maker in Cincinnati who can ship the number of lathes wanted in the time specified. The American Tool Works Co. has fitted up the old plant of the Greenwald Foundry Co., on East Pearl street, with a number of heavy planers and other machines, which will add greatly to the output of the company, which has large orders for lathes and radial drills. The Cisco Machine Tool Co., recently incorporated, is making Cisco lathes for the Cincinnati Iron & Steel Co., which has been a large exporter of lathes to Italy during the past six months. No further developments have occurred in the proposed building of the new plant of the R. K. LeBlond Machine Tool Co., which, if carried out along the lines originally planned, will be one of the largest machine tool plants in the United States.

War Prices Keep Domestic Market Quiet

CONDITIONS in the Chicago machinery market have remained practically unchanged the past week. Demand for machinery and machine tools continues to be greatly in excess of supplies. Foreign buyers are combing the market in an earnest effort to obtain machines for export to be used by the belligerent nations in turning out munitions. Two buyers representing Ward & Co., Birmingham, Eng., were in Chicago the past week after all kinds of machine tools. It is understood that they were unable to procure anything like the quantity desired. The market is featured by the great number of makers who have begun the manufacture of lathes, a line which is far removed from their ordinary channels. Shops are generally engaged now in the manufacture

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of shrapnel and lathes. One large engine producer in this district is said to have begun the manufacture of milling machines, the first in Chicago who has changed to this line. The domestic situation continues to be extremely quiet. This condition is expected to prevail until prices which are now high have approached a basis which is more nearly normal. The American Car & Foundry Co., which recently entered the market for 150 lathes, 27 inches and larger, for its Detroit plant, to make 9-inch shells from forgings and was able to obtain only eight in the Chicago district, is said to have been able to secure a few more in the east.

The National Hose Coupling Co., Chicago, has quoted on 1,000,000 shrapnel shells and on 100,000 aeroplane turnbuckles and has specifications in hand for quotations on 60,000 bayonets and a corresponding number of daggers. Inquiry is also out for 1,000,000 each of four sizes of shrapnel shells, other than those on which the National Hose Coupling Co. has quoted.

EASTERN STATES

BOSTON.—Simon Goodman & Co., 67 Ceylon street, is taking bids on a 1-story, 38 x 71-foot machine shop.

FOREST RIVER, MASS.—Buildings comprising the Chadwick Lead Mills, located between Salem, Mass., and Marblehead, Mass., are undergoing repairs. It is understood they are to be acquired by a syndicate for the manufacture of war munitions.

WEST LYNN, MASS.—General Electric Co. is in the market for a large number of lathes, turret lathes and screw machines.

WOLLASTON, MASS.—Tubular Rivet & Stud Co. has begun work on a 1-story, 50 x 178-foot, factory addition.

WORCESTER, MASS.—Heald Machine Co. has let the contract for a 1-story, 150 x 170-foot addition.

WORCESTER, MASS. — Crompton & Knowles Loom Works has let the contract for a 1 and 2-story addition.

BRIDGEPORT, CONN.—Bridgeport Brass Co. has started work on a 1-story, 45 x 67-foot, boiler house.

BRIDGEPORT, CONN. — Lake Torpedo Boat Co. is in the market for several 3-ton electric travelling cranes.

BRIDGEPORT, CONN. — Lepper Machine Co. has been incorporated; $150,000 capital stock; by William B. Booth, Stratford, Conn., John G. Lepper, Bridgeport and Frank E. Bradley, Derby, Conn.

SPRINGDALE, CONN. — United German Silver Co. has awarded the contract for a 1-story brick factory building, 45 x 90 feet, on which work will be begun at once.

NORTH SMITHFIELD, R. I.—Blackstone Mfg. Co. has let the contract for a 2-story, 90 x 130-foot, mill addition.

ALBANY, N. Y.—Board of contract and supply, this city, will take bids until Sept. 7, on eight motor-driven, centrifugal pumps, three having a capacity of 10,000,000 gallons daily, three 15,000,000 gallons and two 1,500,000 gallons, daily.

BINGHAMTON, N. Y.—Bonds for $30,000 have been voted for the construction of a bridge over Noyse island and a bridge over Pierce creek. Plans will be ready and bids asked about Sept. 15.

BUFFALO.—Lehigh Valley railroad plans $250,000 shops and yards at Tifft street.

BUFFALO.—Buffalo Copper Brass Rolling Mills Co. will build $150,000 addition to its plant.

BUFFALO.—Turner Construction Co., Buffalo, has been awarded the contract for the erection of a 10-story, 105 x 141-foot, concrete and steel cold storage warehouse.

CORTLAND, N. Y.—Gooley & Edlund are excavating for a 2-story, 55 x 160-foot factory addition.

NEW YORK.—C. K. Turner, export agent, 116 Broadway, New York, is in the market for 22 engine lathes, in large or small lots.

NEW YORK.—H. D. Best & Co. has been awarded the contract for the construction of a factory and power house for American Machine & Foundry Co., Fifty-sixth street and Second avenue, Brooklyn, N. Y.

NEW YORK.—Frederick Conlin, 111 Broadway, president of Samuel L. Moore & Sons Corporation, with plant at Elizabethport, N. J., is taking bids on four cranes and other equipment for a shipbuilding plant to be erected at Elizabethport.

NEW YORK.—American Car & Foundry Co. is in the market for a number of engine lathes, axle lathes, and other equipment.

NEW YORK.—Seaboard Air Line is in the market for one 150-ton crane and several smaller cranes.

NEW YORK.—American Locomotive Co. is in the market for a large number of additional lathes, turret lathes, screw machines and other equipment.

NEW YORK.—It is reported that the Seaboard Air Line has put out a list of machine tools superseding the list issued by that road about two months ago.

ROME, N. Y.—Rome Brass & Copper Co. has started work on a 1-story, 140 x 200-foot addition to its casting shop.

SYRACUSE, N. Y.—Syracuse Malleable Iron Works contemplates the erection of three buildings as an addition to the plant.

BELLEFONTE, PA.—Titan Metal Co. has been incorporated; $20,000 capital stock, by C. H. Kerk, Philadelphia, C. Y. Wagner, F. E. Naginey, William P. Seig, John S. Walker, John McCoy and A. Fauble, of Bellefonte, Pa., to manufacture forging bronze; company is closely connected with Bellefonte Engineering Co., manufacturers of power hammers, etc.

BERWICK, PA.—American Car & Foundry Co. will erect an 80 x 480-foot, $90,000 addition.

CURWENSVILLE, PA.—Clearfield & Mahoning railroad has received permission from the water supply commission to erect a bridge across Anderson Creek near this place.

EASTON, PA.—Alpha Portland Cement Co. is in the market for a crane for handling a three-cubic yard bucket.

ELLWOOD CITY, PA.—The Crichton-Curl Enamel Co. is installing some new equipment.

ELLWOOD CITY, PA.—Shelby Tube Co. are having plans prepared for an addition to the foundry and machine shop. Work on the new 240 x 600-foot addition is partially completed.

ERIE, PA.—Erie Steel Construction Co. is furnishing steel for the 2-story warehouse being erected by the Stirling-Warfel Mill Supply Co.

ERIE, PA.—Stirling-Warfel Mill Supply Co. has been incorporated; $4,000 capital stock; by John Stirling, Marian Stirling and Rudolph S. Warfel, to manufacture mill, marine and factory equipment.

ERIE, PA.—Erie Silk Mills, West Twenty-sixth street, has awarded the contract to Henry Schenk Co. for a 1-story, $90,000, sawtooth construction, 144 x 144-foot addition. The building will be of steel construction throughout.

GREENSBURG, PA.—Pittsburgh Engineering Co. contemplates the erection of an addition to its plant at Greensburg.

HARRISBURGH, PA.—Erie County Electric Co. has increased its capital stock from $500,000 to $1,500,000.

HOUTZDALE, PA.—Borough of Houtzdale will construct a bridge across Armstrong Creek.

JOHNSTOWN, PA.—Johnstown Water Co. will build an 800,000,000-gallon reservoir on Laurel street.

JOHNSTOWN, PA.—Cambria county commissioners will build a steel bridge near Bradley Junction.

JOHNSTOWN, PA.—Pennsylvania railroad has asked bids on a new passenger station, specifications for which are in the engineer's office at Philadelphia.

JOHNSTOWN, PA.—Lee Masterton, city engineer, has submitted plans for the $60,000 Homer street bridge, to the state water supply commission; bridge will be of steel construction with a span of 225 feet.

LANCASTER, PA.—Automatic Lighting & Power Co. has been incorporated; $50,000 capital stock; by S. S. Wilson, Roy Ballinger, and others.

LEBANON, PA.—A. S. Kreider, Annville, Pa., is taking sub-bids on the construction of a 6-story, 60 x 180-foot factory, to be erected here.

NEW CASTLE, PA.—Solid Drawn Forging Co. has been incorporated to deal in iron and steel products.

PHILADELPHIA. — Baldwin Locomotive Works is in the market for a large number of engine lathes and turret lathes.

PHILADELPHIA.—Bennet & Aspden Co., Manayunk, will build a 1 and 4-story and basement, 193 x 225-foot, factory building.

PHILADELPHIA.—Pennsylvania Steel Co. has placed an order for a small crane. The company still is in the market for several additional cranes.

PHILADELPHIA.—Wm. Cramp & Sons Ship & Engine Building Co. has put out an inquiry for an additional crane, increasing to five the number for which it is negotiating.

PHILADELPHIA. — Peuckert & Wunder, architects, are taking bids on a 1-story, 140 x 165-foot factory building, to be erected in Camden, N. J. The owner's name is withheld.

PITTSBURGH. — Packard Motor Co. of Pittsburgh has purchased a site and will erect a $300,000, 3-story, brick and stone building.

PITTSBURGH.—Pennsylvania & Lake Erie railroad contemplates laying a double track from New Castle, Pa., to Sharon, Pa.

PITTSBURGH.—Advance Electric Co. has been incorporated; $30,000 capital stock; by Frank M. Kirnan, A. J. Wayman and A. B. Wayman.

PITTSBURGH.—E. H. Coveny, Pittsburgh, has purchased a site 45 x 110 feet and will erect a 6-story fireproof warehouse as soon as the present building is razed.

PITTSBURGH.—John F. Howley & Co. have been awarded contracts for the construction of a bridge over Deer creek in Horner township.

PITTSBURGH.—Bids have been asked by the board of education for the construction of the new Bailey high school, previously mentioned.

PITTSBURGH.—Copper Clad Steel Co. has been incorporated to manufacture copper clad wire for high tension lines; $25,000 capital stock; by S. F. Loeb, F. R. S. Kaplan, S. E. Braner, all of Pittsburgh. Company owns a plant and has recently purchased an electric furnace from the Wile Electric Furnace Co.,

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Jenkins Arcade building, Pittsburgh; some wire drawing equipment may be installed.

PITTSBURGH. — D. T. Riffle has been awarded the contract for the construction of a 6-story, 40 x 140-foot, reinforced concrete warehouse for George S. Dougherty Co.

PITTSBURGH.—United Coal & Coke Co. has been incorporated; $5,000 capital stock; by L. R. Martin, E. C. McHugh and R. T. Rossell.

PITTSBURGH. — Maguire Mfg. Co. has been incorporated; $5,000 capital stock; by J. F. Courson, Pitcairn, Pa.; F. R. Maguire, Charles M. Clarke, Charles Gulland and J. Bailey Brown, Pittsburgh.

PITTSBURGH. — Steel Car Forge Co., Frick building, Pittsburgh, will build a new machine shop at its Ellwood City, Pa., plant; a number of iron working tools will be purchased.

PITTSBURGH.—Allegheny county commissioners have been notified that the water supply commission has approved plans for a bridge across Big Sewickley Creek near Ambridge, Pa.

PITTSBURGH.—Robert W. Hunt & Co., consulting engineers, will receive bids until Sept. 25 for 825 tons of steel for bridges for the Hankow-Iehand section of the Chinese Hankow-Szechuan government railroad, China.

PITTSBURGH.—Tubular Products & Steel Works will build new plant near the Pennsylvania railroad, at Reading, O.; E. D. F. Nesbit, architect, First National Bank building, Pittsburgh, has plans.

PITTSBURGH.—H. M. Cribbs, Allegheny county controller, is asking bids for repairs to the trestle approach, steel, street car rails and floor of bridge No. 6 over the Youghiogheny river; J. G. Chalfant is county engineer.

READING, PA.—Grey Foundry & Machine Co.'s plant here has been sold for $14,000 to H. Claude Bell of the Reading Casting Co.

SHARON, PA.—Bids will be asked shortly for a bridge of steel and concrete construction, over the Shenango river at State street.

SHARON, PA.—Valley Mold & Iron Co., Sharpsville, has awarded contracts to McMylar Construction Co., Cleveland, for the erection of a steel building, 75 x 150 feet; contracts for two other buildings 75 x 50 feet and 70 x 375 feet will be awarded shortly; new buildings will be of steel construction.

SOUTH BETHLEHEM, PA. — Bethlehem Steel Co. has issued an inquiry for three additional cranes, making a total of 12 for which it still is in the market.

TAMAQUA, PA. — The water commission has completed plans for a 357,000,000-gallon reservoir to cost about $100,000.

UNIONTOWN, PA.—Harry Kisinger, Fayette county controller, is asking bids for the construction of abutment and wing walls and repairs to several county bridges.

WARREN, PA. — McClintic-Marshall Co., Pittsburgh, has begun the erection of a $50,000 concrete and glass, blacksmith shop, 200 x 200 feet, for Struthers-Wells Co.

WEST CHESTER, PA.—Dunleany Brothers, Coatsville, Pa., have been awarded the contract for erection of a 65-foot span steel bridge.

WEST MILTON, PA.—Robert Grace Co., Pittsburgh, has been awarded the contract for the construction of the superstructure and masonary of a $300,000 bridge for the Philadelphia & Reading railroad.

WILKSBARRE, PA.—Citizens have voted $300,000 for the elimination of grade crossings of the Pennsylvania railroad.

AMPERE, N. J.—Crocker-Wheeler Co. is taking bids on two 5-ton and two 10-ton traveling cranes.

ATLANTIC CITY, N. J.—A $1,000,000 hotel will be erected by Alexander Chambley, Philadelphia, on the site of the Rudolf. Vivian Smith and Earl Henderer are the architects.

BORDENTOWN, N. J.—American Ammunition Co. is in the market for a number of small precision lathes.

CAMDEN, N. J.—Wood Mfg. Co. has taken bids for the construction of a 1-story, 142 x 164-foot, factory building.

CENTRAL STATES

AKRON, O.—Williams Foundry & Machine Co. will build a $15,000, 92 x 125-foot, 2-story brick addition to its machine shop.

ALLIANCE, O.—Alliance Structural Co. will erect a 100 x 250-foot addition to its plant.

ALLIANCE, O.—Alliance Engineering Co. has been incorporated by the interests of the Alliance Machine Co. and will erect 120 x 400-foot building.

CINCINNATI.—Greaves-Klusman Tool Co. will add one story to its present building, which is 38 x 121 feet.

CINCINNATI, O. — Receivers of Chicago, Hamilton & Dayton railroad have been authorized to reconstruct the bridge over the Sangamon river, near Decatur, O. The cost of reconstruction is estimated at $31,000.

CLEVELAND.—Kessler Mfg. Co., 1,000 Newburg avenue, plans a $14,000 addition.

CLEVELAND.—Perfection Spring Co. has let the contract for an addition.

CLEVELAND.—Standard Welding Co., J. E. Manternach, general manager, will erect a 4-story, 60 x 300 and 1-story, 100 x 200-foot extension to its plant. J. C. Clapper, chief engineer of the company, is preparing plans.

CLEVELAND.—Moline Plow Co., Moline, Ill., has purchased the plant of Avery Stamping Works. Special machinery will be installed at once for the manufacture of shrapnel.

COLUMBUS, O.—Bonds for $100,000 have been voted for the repair of bridges in Franklin county. John Scott is county clerk.

COLUMBUS.—Foster Gear Co. plans an addition to the plant on Kaiser street. The company has a capacity of 30,000 steering gears a year.

COLUMBUS, O.—Dunlap Engineering Co. has been reorganized; $50,000 capital stock; F. B. Chapman, president, T. C. Dunlap and H. N. Rose. The company will build machine tools.

CUYAHOGA FALLS, O. — Falls Hollow Staybolt Co. has plans in progress for a 1-story, 150 x 600-foot, factory building.

DAYTON, O.—Dayton Munitions Co. has been incorporated; $10,000 capital stock; by Robert K. Landis, and others.

DAYTON, O.—Dayton & St. Marys Traction Co. has been incorporated; $10,000 capital stock for preliminary work; by Judge Dennis Dwyer, Dayton, O., president, J. B. Raterman, Ft. Laramie. The line will extend 16½ miles from Ft. Laramie to Covington, O.

GREENTOWN, O.—Greentown Aluminum Co., of which G. D. Townsend, Folwell building, Canton, O., is secretary, will erect a 1-story, 46 x 114-foot building here. W. C. Owen & Co., Leader-News building, Cleveland, is preparing plans.

HAMILTON, O.—County commissioners will advertise for bids shortly for the 730-foot Columbia street bridge.

HAMILTON, O.—Bids will be received by the county auditor until Sept. 13 for the construction of a steel and concrete bridge over Miami river at Chestnut street. W. W. Crawford, auditor.

LOWELLVILLE, O.—Citizens are considering a $5,000 bond issue to help pay the cost of building a bridge across the Mahoning river.

MARION, O.—Plans have been prepared for rebuilding Marion National Milling Co.'s plant. The elevator will be a 120-foot, concrete and steel, with 50,000-bushel capacity. Contracts will be let shortly.

NILES, O.—Board of commissioners of Trumbull county is asking bids for the construction of the substructure and superstructure of the Summit street bridge.

PAINESVILLE, O.—Board of control of this city has awarded Kerr Turbine Co., Wellesville, N. Y., the contract for the turbine and generator to be installed in municipal light plant.

TIFFIN, O.—Tiffin Waterworks has increased its capital stock from $100,000 to $143,500.

TOLEDO, O.—A $140,000 draw bridge will be erected over the Erie canal near Walbridge park.

WAPAKONETA, O.—Bids will be received until Sept. 4, for the construction of one plate girder bridge over M. & E. canal, New Bremen, O.; one plate girder bridge over the same stream at Second street, New Bremen, O., and one steel bridge in Wayne township. J. H .Meyer is county engineer. F. W. Langhorse, auditor Auglaize county.

WARREN, O.—Trumbull Steel Co. will make the following additions: Erection of 580-foot bar shed; increase the mill building 300 feet; shear shed to be enlarged by a 360-foot addition; and add to the annealing and galvanizing departments.

YOUNGSTOWN, O.—Lake Shore railroad soon will ask bids for the new East Federal street bridge.

YOUNGSTOWN, O.—Plans have been prepared for two steel bridges known as the Millings Mill bridge and the Fredericksburgh road bridge. The city engineer announces that bids will be received and contracts awarded within 30 days.

CHARLESTOWN, W. VA.—Frank G. Burdette, engineer, has received instructions from the county court of Kanawha county to prepare plans for a 150-foot bridge over Danis Creek; bridges also will be built over Upper Creek and Morris Creek.

FAIRMOUNT, W. VA.—A. L. Anderson & Bros., Altoona, Pa., will build six miles of railroad for the Fairmount-Helen Run Railway Co.

HUNTINGTON, W. VA.—Kenova Mine Car Co. has purchased the plant formerly owned by the Independent Bridge Co.

MARTINSBURG, W. VA.—Potomac Light & Power Co., capital $1,000,000, incorporated by Emory L. Coblentz and others will spend about $100,000 in enlarging and improving the company's plant at Hagerstown, W. Va.

WHEELING, W. VA. — It is unofficially reported the Wheeling Steel & Iron Co. will add 12 hot mills and auxiliary equipment to its tin plate plant at Yorksville, O. As previously reported, the company contemplates improvements to its pipe mill.

COVINGTON, KY.—City commissioners announce that the proposed bridge over Licking river will cost $47,000; will be 725 feet long, 16 feet wide, and 80 feet above the low water mark. Construction will start as soon as authorized by the state.

ELIZABETHTOWN, KY.—Bids will be received in October for the construction of a $17,500 steel bridge on concrete foundations over Rolling Fork river near Woolbridges ferry. J. S. Irwin, Elizabethtown, Ky.

LOUISVILLE, KY.—Nicholson System Sales Co. has been incorporated to manufacture and

sell a fuel saving device; $6,000 capital stock; by D. L. Taylor and others.

ANDERSON, IND. — Griff-Kimberly Lawn Mower Co. is installing machinery to manufacture lawn mowers. Additional machinery will be purchased.

EVANSVILLE, IND.—Evansville Packing Co. will make extensive improvements in its plant. The company plans the erection of a $150,000 building. Morton Mannheimer announces that one of the older buildings will be completely overhauled.

INDIANAPOLIS, IND.—Van Briggle Motor Device Co. has been incorporated to manufacture carburetors; $150,000 capital stock; by L. H. Van Briggle.

BLOOMINGTON, ILL.—Schofield Heater Co. has been incorporated; $25,000 capital stock; by Floyd Schofield, H. A. Chenery, and A. R. Moore.

CHICAGO.—William Ross Engineering Co has been incorporated; $5,000 capital stock; by William Ross, Edwin T. Hanson, and Robert Branard Jr.

JOLIET, ILL.—Blast furnace No. 2 of Illinois Steel Co.'s plant will start operating shortly, making four furnaces working here.

KULPMONT, ILL.—J. H. and C. K. Eagle, Shamokin Silk Mills Co., have purchased a site and will erect a 4-story, 60 x 238-foot concrete and steel weaving mill, and a 1-story, 50 x 50-foot concrete power plant.

GRAND RAPIDS, MICH.—Adolph Leitelt Iron Works has been incorporated; $500,000 capital stock; to carry on a general foundry and machine shop business.

HANNIBAL, MO.—Hannibal Wire Fabric Co. has been incorporated; $10,000 capital stock; by Bert Wiley, E. E. Heindel, and Fred Kansteiner.

JOPLIN, MO. — Preliminary work on the construction of a 400 ton concentrating plant at Dick Turpin mine has been started. O. W. Sparks, is superintendent.

WEBB CITY, MO.—Media Mining Co. is erecting a concentration mill, of 1,200 tons daily capacity.

ATLANTIC, IA.—A. A. Mickel announces that the grain elevator, recently damaged by fire, will be rebuilt.

WAVERLY, IA.—Eldredge Steel Gate Co. has been incorporated; $25,000 capital stock; by W. M. Brooks, and R. J. Eldredge.

SOUTHERN STATES

APEX, N. C.—Municipal Service Corporation has been granted a franchise to construct and operate an electric light plant, waterworks and sewer system. Plans will cost about $40,000.

WILSON, N. C. — Mattamuskeet drainage commission will construct a single leaf, plate and girder, Scherzer, rolling-lift bridge over the outfall canal. Lawrence Brett, is engineer, Wilson, N. C.

DAYTONA, FLA.—Daytona Electric Light & Power Co. has been incorporated; $500,000 capital stock; by Michael Sholtz, James K. Atkinson and David Sholtz.

SALERNO, FLA.—Electric light and waterworks plant will be constructed by M. W. Mulford and others at an estimated cost of $200,000.

RUSSELLVILLE, ALA. — Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., will make $50,000 worth of improvements at Russellville ore mines. The following is partial list of the equipment to be installed; 6,000 feet 10-inch pipe line; 10-inch, 2-stage centrifugal, electrically-driven pump; two 300-kilowatt Westinghouse turbo-generators.

DALLAS, TEX.—City has awarded Dallas foundry contract for 12,500 concrete meter boxes.

DALLAS, TEX.—Northern Texas Traction Co. plans $500,000 concrete and steel street car viaduct between Dallas and Oak Cliff, Tex. Stone & Webster Engineering Corporation, 147 Milk steret, Boston, Mass., is the engineer.

WICHITA FALLS, TEX.—Plans have been completed for the construction of an oil refinery of 1,000 gallons daily capacity. The plant will cost about $25,000. Farquharson & Manross, are superintendents.

FORT SMITH, ARK.—Fort Smith Iron & Steel Co., idle some time, will commence operations shortly. Border City Iron & Steel Co. has taken over the plant. William M. Bushnell, is general manager.

BEAVER, OKLA. — Beaver Construction Co. has been incorporated; $10,000 capital stock; by Joseph A. Tack, Leo Tack, Wichita, Kas., and J. H. Morgan, Alva, Okla.

Certainly Not!

You wouldn't THINK of Starting a Minute Late for a Limited train, would you? Then why Delay Here? GET ABOARD THE "LIVE WIRE LIMITED!"

American Ammunition Co., Bordentown, N. J., is in the market for a number of small precision lathes.

Steel Car Forge Co., Frick building, Pittsburgh, will build a machine shop at Ellwood City, Pa. A number of metal working tools will be purchased.

Robert W. Hunt & Co., consulting engineer, Monongahela building, Pittsburgh, will receive bids until Sept. 25 for 825 tons of steel for bridges for Chinese government railroad, China.

A complete electric lighting system is to be installed at Hysham, Mont. Billings Engineering & Construction Co., Billings, Mont., consulting engineers.

Griff-Kimberly Lawn Mower Co., Anderson, Ind., is installing machinery to manufacture lawn mowers. Additional machinery will be purchased.

Hafner Mfg. Co., St. Louis, will erect a $50,000 2-story, concrete and brick, 85 x 120-foot addition. Electric elevators will be installed.

Lake Topedo Boat Co., Bridgeport, Conn., is in the market for several electric traveling cranes having a capacity of three tons each.

Board of contract and supply, Albany, N. Y., will receive bids until Sept. 7 for eight motor-driven, centrifugal pumps, three having a daily capacity of 10,000,000 gallons, three with a daily capacity of 15,000,000, and two with a daily capacity of 1,500,000 gallons.

American Car & Foundry Co., Detroit plant, is in the market for a number of engine lathes, axle lathes and other equipment.

Bethlehem Steel Co., South Bethlehem, Pa., has issued an inquiry for three additional cranes making a total of 12 for which it is in the market.

Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., will make about $50,000 worth of improvements at the Russellville ore mines. The following is a partial list of equipment to be installed: 6,000 feet of 10-inch pipe line; 10-inch, 2-stage, centifugal, electrically-driven pump; two 300-kilowatt, Westinghouse, turbo-generators.

WESTERN STATES

TOPEKA, KAS.—Santa Fe railroad will make extensive improvements on the telegraph lines between Topeka and Argentine. Sixty-four miles of line will be rebuilt at an estimated cost of $30,000. The line is owned jointly by Western Union Telegraph Co. L. M. Jones is superintendent of telegraph division.

DILLON, MONT.—Bids will be received by the commissioners of Beaverhead and Madison counties until Sept. 10, for the construction of a 170-foot steel bridge over Big Hole river.

PORTHILL, IDA.—Plant of Idaho Continental mine, twenty-six miles from here, damaged by fire, will be rebuilt. The plant includes a concentrator, compressor, machine shops and heating units. A. Klockmann is president.

ABERDEEN, WASH.—The city has purchased the West toll bridge, which recently collapsed, and will replace it with one 260-foot, structural steel span, and one 118-foot structural steel span. Plans will be completed about Sept. 4. C. E. Fowler, Central building, Seattle, is consulting engineer. L. D. Kelsey is city engineer.

ANACORTES, WASH. — Great Northern railroad plans the erection of a roundhouse.

OLYMPIA, WASH.—The contract for the construction of a 95-foot span steel bridge over Skyhomish river, Mason county, has been awarded by the state highway commission to Yelverton & Wolfe, Olympia.

PUGET SOUND, WASH. — U. S. navy yard will receive bids until Sept. 11 for the construction of one steel frame shell house, and two brick magazines with steel trusses.

SEATTLE.—Seattle Copper Works has been awarded the contract for copper piping used on the government lighthouse tender, Rose.

SPOKANE, WASH.—County commissioners plan a reinforced concrete span to replace the present structure at the foot of Monroe street.

SPOKANE, WASH.—Power and compressor plants, timber sheds, and boiler house at the Rex mine, were damaged by a $10,000 fire.

WINLOCK, WASH.—Vaness Lumber Co. will rebuild the mill recently damaged by fire.

CANYON CITY, ORE.—Prairie City Light & Power Co. contemplates the extension of the plant to supply power for dredging.

PENDLETON, ORE. — The contract for the erection of Riverside bridge has been awarded to Illinois Steel Co., of St. Paul.

PORTLAND, ORE.—Theodore Berheim & Co.'s wool warehouse was damaged by a $50,000 fire.

OAKLAND, CAL. — Plans have been completed and work will start shortly on the plant of the Pacific Coast Shredded Wheat Co. Contract for the ornamental iron has been awarded to California Metal Works; Otis Elevator Co. has been awarded the contract for elevators.

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

(Delivery to Dec. 31.)

Bessemer, valley	$15.50
Bessemer, Pittsburgh	16.45
Basic, Pittsburgh	15.20 to 15.45
Basic, eastern Pa.	15.50 to 16.00
Malleable, Pittsburgh	15.45
Malleable foundry, Chicago	13.50
Malleable foundry, Philadelphia	15.50 to 16.00
Malleable foundry, Buffalo	14.50 to 14.75
No. 1X foundry, Philadelphia	16.00 to 16.25
No. 2 foundry, Pittsburgh	15.45
No. 2 foundry, valley	12.75 to 13.00
No. 2 foundry, Cleveland	14.50
No. 2 foundry, Ironton	14.00
No. 2 foundry, Chicago	13.50
No. 2X foundry, Philadelphia	15.50 to 16.00
No. 2X fdy., N. J. tidewater	15.50 to 16.00
No. 2X foundry, Buffalo	14.50 to 14.75
No. 2 plain, Philadelphia	15.00 to 15.50
No. 2 plain, N. J. tidewater	15.00 to 15.50
No. 2 plain, Buffalo	14.25 to 14.50
No. 2 southern, Birmingham	11.50
No. 1 southern, Cincinnati	14.40
No. 2 southern, Chicago	14.50 to 15.00
No. 2 southern, Phila. delivery	14.00 to 14.25
No. 2 southern, Cleveland	15.00
No. 2 south'n, New York docks	13.75 to 14.00
No. 2 southern Boston, docks	13.75 to 14.00
No. 2 south. interior, New Eng.	14.50 to 15.50
No. 2 southern, St. Louis	14.40
Virginia No. 2X furnace	12.50 to 13.00
Virginia 2X, Philadelphia	15.25 to 15.75
Virginia 2X, Jersey City	15.60 to 16.10
Virginia 2X, Boston points	15.75 to 16.25
Gray forge, eastern Pa.	14.75 to 15.00
Gray forge, Pittsburgh	14.95
Gray forge, Birmingham	9.00
Silveries, 8 per cent, Jackson, O.	16.50 to 17.00
Silveries, 5 per cent Birmingham	13.00
Silveries, 5 per cent, Chicago	16.35
Standard low phos., Phil.	23.00 to 23.50
Lebanon low phos., furnace	18.00 to 18.50
Low phos., Pittsburgh	20.95 to 21.20
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	15.75 to 16.25
Charcoal, Buffalo	16.75 to 18.25
Charcoal, Birmingham	21.50

IRON ORE

Lake Superior Ores.

(Lower lake ports.)

Old range Bessemer, 55 per cent	$3.75
Mesabi Bessemer, 55 per cent	3.45
Old range, non-Bess., 51½ per cent	3.00
Mesabi non-Bessemer, 51½ per cent	2.80

Foreign Ores.

(Per unit Philadelphia.)
(Prices nominal.)

Foreign Bess., 50 to 65 per cent	8 to 8½c
For'n non-Bes., 50 to 65 per cent	8 to 8½c

COKE

(At the ovens)

Connellsville furnace	$1.60 to 1.75
Connellsville fur. contr.	1.75 to 2.00
Connellsville foundry	2.15 to 2.50
Connellsville fdy. contr.	2.25 to 2.70
Wise county furnace	2.00 to 2.25
Wise county foundry	2.40 to 2.60
Pocahontas furnace	2.00 to 2.50
Pocahontas foundry	2.25 to 2.50
New River, foundry	2.50 to 3.25
New River, furnace	2.25 to 2.50

FERRO-ALLOYS

Ferro mang., furnace (prompt)	105 to 110
Ferro mang., Balti. (future)	100.00
Ferro-silicon, 50 per cent, Pbgh.	73.00 to 75.00
Ferro-silicon, 50 per cent, Phila.	73.00 to 75.00
Ferro-sil., 12 to 13 per cent.	21.50
Ferro-sil., 11 to 12 per cent.	20.50
Ferro-sil., 10 to 11 per cent.	19.50
Ferro-sil., 9 to 10 per cent.	18.50
(Ferro-silicon quoted at furnace Jackson and New Straitsville.)	Ashland,
Ferro-carbon titanium, carloads, per lb.	8c to 12½c
Ferro vanadium, Pbgh. per lb. alloy	2.25 to 2.30
Ferro tungsten, per lb. of alloy, nom.	3.25
Ferro chrome, per lb., Niagara Falls	20c.

SEMI-FINISHED STEEL

Open hearth billets, Phila.	$31.00 to 33.00
Forging billets, Phila.	35.00 to 40.00
Forging billets, Pbgh.	29.00 to 30.00

Freight Rates via Panama Canal

Rates on finished materials, including plates, shapes, bars, wire, nails, etc., to Pacific coast points via Panama canal, per 100 lbs., in carload lots, exclusive of insurance and dockage.

From New York	$0.40
From Pittsburgh	.619
From Youngstown	.619
From Niles	.619
From Wheeling	.619
From Steubenville	.619
From Johnstown	.604
From Coatesville	.545
From Steelton	.555
From Bethlehem	.529
From Cleveland	.65
From Chicago	.765

Wire rods, Pittsburgh	$27.00
Bess. bill., Youngstown	23.00
Open hearth billets, Youngstown	24.00
Bessemer billets, Pittsburgh	23.00
Open hearth billets, Pittsburgh	24.00
Bess. sheet bars, Youngstown	24.00
Op. h'th sheet bars, Youngstown	25.00
Bess. sheet bars, Pittsburgh	24.00
Op. h'th sh. bars, Pbgh.	25.00
Muck bar, Pittsburgh	27.00

RAILS AND TRACK MATERIAL

Stand. Bess., rails, Pbgh.	1.25c
Stand. open-hearth rails, Pbgh.	1.34c
Lgt. rails, 8-lbs., Pbgh. & Chgo.	1.22c
Lgt. rails, 12 lbs. Pbg. & Chgo.	1.17c
Lgt. rails, 16 to 20 lbs., Pgh. & Chgo.	1.12c
Lgt. rails, 25 to 45 lbs., Pbgh. and Chgo.	1.07c
Relaying rails, standard, Pbg. & Chgo.	$23.00 to 24.00
Relaying rails, light, Chgo.	21.50 to 22.50
Angle bars, st. sect. Pbgh. base.	1.50c
Angle bars, st. sections, Chicago	1.50c
Spikes, railroad, Pbgh.	1.50c to 1.55c
Spikes, railroad, Chgo.	1.65c
Track bolts, Pbgh.	2.00c
Track bolts, Chgo.	2.00c

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—	
Cleveland	$0.95
Newark, N. J.	3.00
New England	3.00
Philadelphia	2.79
Pittsburgh	.95
St. Louis	3.18
Buffalo to:—	
Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York and Brooklyn (by canal)	1.00 to 1.50
Virginia furnaces to:—	
Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88
Birmingham, Ala., to:—	
Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky.	2.65
New York (all rail)	6.15
New York (rail and water)	4.25
Philadelphia (all rail)	5.20
Philadelphia (rail and water)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75
Chicago, to:—	
Des Moines	$2.80
Milwaukee	.50
Moline, Ill.	1.47
Omaha	3.58
St. Louis	1.58
Ironton and Jackson, O., to:—	
Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

SHAPES, PLATES AND BARS

Structural shapes, Pittsburgh	1.30c to 1.35c
Structural shapes, Chicago	1.49c
Structural shapes, Philadelphia	1.509c
Structural shapes, New York	1.519c
Struc. shapes, San Francisco	2.00c to 2.05c
Tank plates, Chicago	1.44c to 1.49c
Tank plates, Pittsburgh	1.30c to 1.35c
Tank plates, Philadelphia	1.509c
Tank plates, New York	1.509c
Bars, soft steel, Pittsburgh	1.30c to 1.35c
Bars, soft steel, Chicago	1.49c
Bars, soft steel, Philadelphia	1.509c
Bars, soft steel, New York	1.469c
Hoops, carloads, Pittsburgh	1.40c
Bands, Pittsburgh	1.30c to 1.35c
Shafting, Pbgh., contr. car loads	64 to 65 off
Bar iron, Chicago	1.25c
Bar iron, Philadelphia	1.409c
Bar iron, New York	1.419c to 1.469c
Bar iron, Cleveland	1.20c to 1.25c
Bar iron, Pittsburgh	1.30c
Hard steel bars, Chicago	1.30c
Smooth finish, mchy. steel, Chi.	1.68c

SHEETS AND TIN PLATE

No. 28, black, Pittsburgh	1.85c to 1.90c
No. 28, black, Chicago	2.04c
No. 28, tin mill, black, Pbgh.	1.80c to 1.85c
No. 28, galvanized, Pbgh.	3.75c to 4.00c
No. 28, galvanized, Chgo.	3.69c to 3.94c
No. 10, blue, anld., Pbgh.	1.40c to 1.50c
No. 10, blue, annealed, Phila.	1.609 to 1.659c
Tin plate, 100 lb., coke base.	3.10c to 3.20c

EXTRAS FOR SHEET OR TIN MILL SPECIFICATIONS

(Per hundred pounds.)

Single pickled, cold roll, and re-anl.	30 cents
Hot roll'd pick'd and anl., tin mill	25 cents
Full pickl'd, cold rolled and re-anl.	50 cents
Auto sheets	75 cents
Blued stove pipe stock	10 cents
Range steel	30 cents
Re-squarring	10 cents
Roller leveling	10 cents
Patent leveling and re-squarring	35 cents
Oiling sheets	10 cents
Deoxidizing	10 cents
Lime finish	10 cents
Open-hearth stamping steel, free from mill scale	55 cents
Special open hearth deep stpg. steel free from mill scale	80 cents
Extra deep special auto body stock	$1.25
Ext. for 28 gage ov. 32 to 36-in. wide	10 cents

No reduction for sheets not annealed.

The above extras apply on both sheet and tin mill specifications, at the same rate.

IRON AND STEEL PIPE

(Pittsburgh.)

	Black. Butt-weld.	Galv. Butt-weld.
Steel, ⅜ to 3 inches	79	63½
Iron, ⅜ to 2½ inches	71	52
	Lap-weld.	
Steel, 2½ to 6 inches	78	62½

BOILER TUBES

Steel, 3½ to 4½ inches l. c. l.	72
Iron, 3½ to 4½ inches l. c. l.	61

WIRE PRODUCTS

(Retailers' price 5 cents above jobbers' quotation.)

Wire nail jobbers, Pittsburgh	$1.65
Plain wire, jobbers, Pittsburgh	1.50
Galvanized wire, jobbers, Pbgh.	2.10
Polished staples, Pbgh.	1.80
Galvanized staples, Pbgh.	2.40
Barb wire, painted, jobbers, Pbgh.	1.80
Barb wire, galv., jobbers, Pbgh.	2.40